SCIENTIFIC AMERICAN

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Vol. XCI.—No. 26.
ESTABLISHED 1845.

NEW YORK, DECEMBER 24, 1904.

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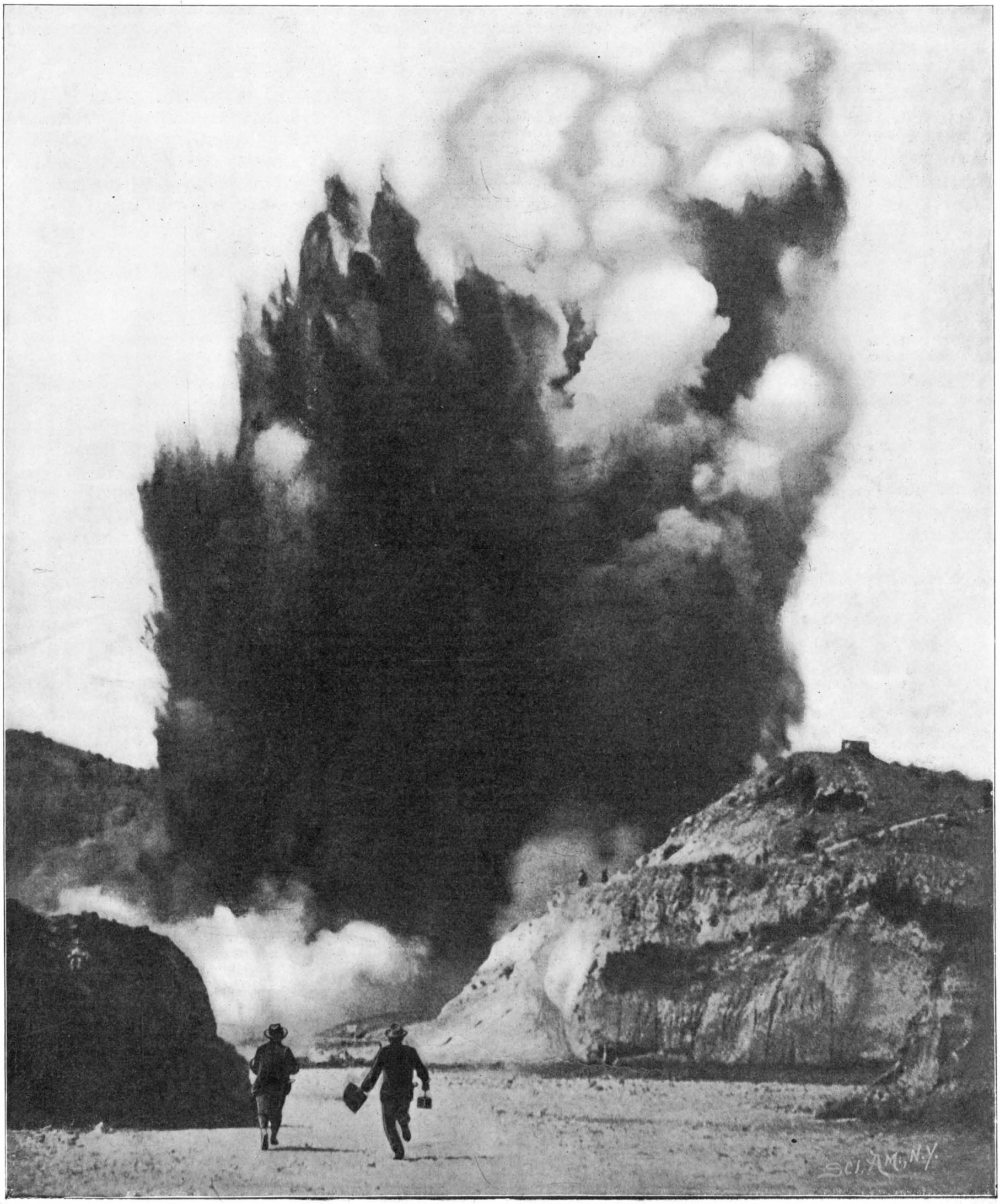
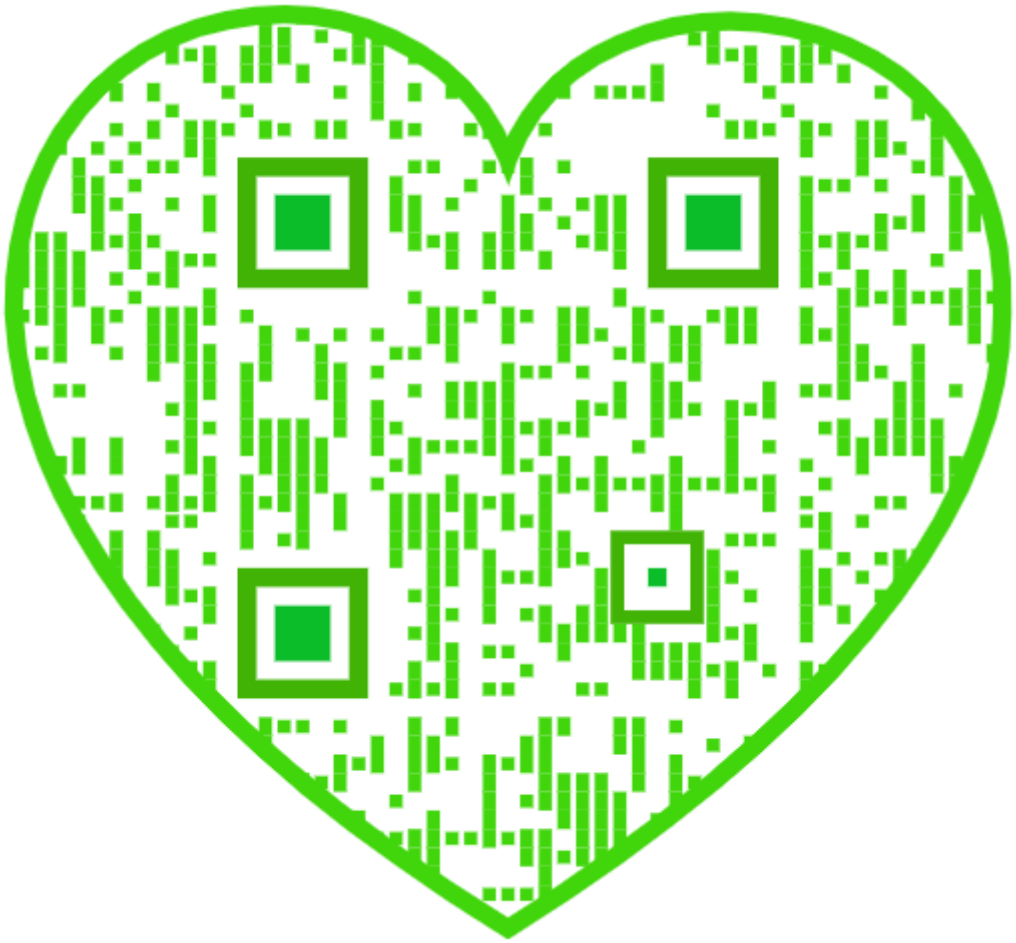


"WAIMANGU," A GIANT GEYSER OF NEW ZEALAND THAT AT TIMES SPURTS MUD AND STEAM TO A HEIGHT OF 1,000 FEET.—[See page 465.]



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ESTABLISHED 1845

MUNN & CO., - - Editors and Proprietors

Published Weekly at

No. 361 Broadway, New York

TERMS TO SUBSCRIBERS

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One copy, one year, to any foreign country, postage prepaid. £0 16s. 5d. 4.00

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (Established 1845)..... $3.00 a year
Scientific American Supplement (Established 1876) ..... 5.00 "
Scientific American Building Monthly (Established 1885)..... 2.50 "
Scientific American Export Edition (Established 1878)..... 3.00 "

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MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, DECEMBER 24, 1904.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

A GREAT PUBLIC IMPROVEMENT.

The opening of the new Chicago subway, which is scheduled to take place next January, provides that city with a system of transportation for freight which will not only prove of immediate relief, and great business utility, to Chicago, but must in the long run react favorably upon other great cities where the congestion of street freight traffic is already a serious problem, and promises to become an intolerable burden as the years go by. The Chicago subway, as planned, has a total length of 60 miles, of which 22½ miles have been completed and are shortly to be opened as stated above. The road will be used strictly for the haulage of freight, and for this service the road, when fully equipped, will be provided with several thousand cars and 150 electric rack locomotives, the locomotives being small in size, and depending upon a rack rail in the center of the track for securing the necessary tractive effect. The new subway is designed to take the place of the horse-drawn trucks in the transportation of freight from the many freight depots to the doors of the various business houses, where the merchandise will be unloaded directly from the cars of the subway to the basement floors. Not only so, but the coal for power purposes and the ashes will be brought and removed from the basement in the same way. A special type of car has been built for the subway, of dimensions suitable to the section of the tunnel, and capable of carrying a load of 15 tons. The subway is constructed in two sizes. The main lines which extend below the principal streets of the districts served are 11 feet 2½ inches in width and 12 feet 6 inches in height, while the branch lines which serve the intersecting streets are 6 feet in width and 7 feet 6 inches in height.

Now here is the practical realization of a scheme which has frequently been suggested as the best solution for the crowded freight traffic of the busiest portions of New York city. The district in Chicago that will be most richly benefited is a section less than two miles square, in which is included all of the great freight stations, and in this section is located the principal shopping district. A freight system applied to New York would involve the construction of trunk lines below the streets bordering the East and North rivers, with a system of feeder lines running below the crosstown streets to serve the business houses. Such a system would not only serve to relieve the too narrow cross streets of the slow-moving and bulky trucks that incumber them and so badly congest traffic, but it would mean the clearing from the sidewalks of the mass of freight which now incumbers them and renders the progress of the foot passengers not merely exasperatingly slow, but, as several fatal accidents have shown, positively dangerous.

A CANARD AND ITS REFUTATION.

That was a stupid canard which was cabled recently from England, to the effect that the turbines of the new transatlantic steamer "Victorian" had failed on trial to give the expected results. As a matter of fact, the turbines were not even in the ship at the time the cable was published. In view of this attempt to prejudice the reputation of the coming prime mover, the recent publication by the British navy of the results of a series of comparative trials of identical cruisers fitted with reciprocating engines and turbines is very timely, for they show that so far from there being any indications that marine turbines will be a failure, there is every reason to expect that they will prove a success so brilliant as to relegate the reciprocating marine steam engine, at least as the motive power of high-speed vessels, to the limbo of outbuilt and discarded mechanisms.

Now this is a pretty strong statement; but our readers will agree that it is justified by the extraordinary results attained in the first authentic and absolutely fair competitive trial of turbines against reciprocating engines as given below. It happened in this way: There have recently been built for the British navy four cruisers of 3,000 tons displacement, 9,000 contract horse-power, and 21¾ knots contract speed. The vessels were identical in everything except the engines, which in three of the cruisers were of the reciprocating type, and in the fourth—the "Amethyst"—were of the well-known Parsons turbine type. The ships recently completed a series of very exhaustive trials carried out by the trained experts of the British navy, under conditions that preclude any possibility of error, and render the remarkable results secured authentic and reliable. The trials were executed in periods of 24 to 36 hours of continuous steaming, and at speeds of from 10 knots to the maximum of which the respective vessels were capable. At a speed of 14 knots the water and coal consumption and the general economies of the two types were about the same. As the speed fell below 14 knots, the reciprocating engine showed proportionately better results, but from 14 knots upward the turbines proved to be on every point of comparison superior. As the maximum speed was reached, the turbines proved so greatly superior as to render the reciprocating engine by comparison a costly, clumsy, and relatively very inefficient machine. We herewith append a table showing comparative results at the maximum speed at which the two types could be driven:

COMPARATIVE EFFICIENCY AT MAXIMUM SPEED.

	Reciprocating Engines.	Turbine Engines.
Displacement of ship, tons	3,000	3,000
Maximum speed	22.24	23.63
Maximum horse-power	9,600	14,000
Horse-power, per ton weight	18 3	26.0
Coal, per horse-power per hour	2.65	1.74
Radius in miles at 20 knots	2,140	3,160

We must confess that while we were prepared to see the turbine show the better results, we were altogether unprepared for the amazing superiority indicated by these figures. Regarding the performance at lower speeds, mention should be made of the fact that in the reciprocating engines, the exhaust steam from the auxiliaries (representing at low speed about one-fourth of the total steam drawn from the boilers) was turned into the receivers of the low-pressure cylinders, an arrangement which, as was shown in our recent article on the trials of the cruiser "Pennsylvania," conduces to high economy. In the present trials no such provision was made for the turbine engines; and it is the opinion of the naval engineers that when this has been done the "Amethyst" will compare favorably with the other boats, even at speeds below 14 knots. A study of the details of this test shows that when running at 20 knots the turbine ship required 30 per cent less coal and steam than the others; at 18 knots the saving was about 20 per cent; at 16 knots about 10 per cent; while at 14 knots the consumption was about the same. The gain of more than a knot and a quarter per hour when the engines were being pushed to their limit is particularly important when it is borne in mind that the air pressure in the boiler rooms was only 1.7 against as high as 2½ inches in the other ships; for this of course means that there is considerably less wear and tear on the boilers. It should further be mentioned that, for cruising at low speeds, the "Amethyst" was fitted with an extra set of turbines, which would not be necessary in merchant ships, which always run at about their maximum speed. Therefore the horse-power per ton weight of machinery would, if this had been a merchant vessel, have been even higher than the 26 horse-power shown in our table. At 18 knots the turbine required about 3 pounds less steam per horse-power per hour; at 20 knots, 5¼ pounds; and at full power, from 7 to 8 pounds less steam, or a reduction of over 30 per cent. So with the coal consumption, although at 10 knots it was 3.22 pounds as against 2.56 pounds in the reciprocating engines, at 14 knots it was about the same, at 18 knots it was 20 per cent less, at 20 knots 30 per cent less, and at full power the turbine engines demanded 1 pound per horse-power per hour, or 40 per cent, less than did the reciprocating engines.

The most important feature, however, to the naval architect and the student of tactics and strategy, is the greatly increased radius of action due to the economy of the motive power. The "Amethyst" type of cruiser carries 750 tons of fuel under normal conditions; and at 18 knots the turbine ship with this supply could travel 3,600 miles as against 2,770; at 20 knots it could travel 3,160 as against 2,140 miles, while at the remarkable speed of 23.63 knots, the "Amethyst" could steam 1,620 miles as against 1,420 miles for the vessel carrying reciprocating engines and making only 22 knots an hour.

Experience has shown that the larger the units in which the turbine is built, the greater are the economical results obtained. Therefore it is reasonable to expect that the 18-knot "Victorian" of the Allan Line, and in a still greater degree the 25-knot liners of the Cunard Company, will show a speed and economy that will greatly surpass even the extraordinary results obtained in these naval trials.

Further testimony of the efficiency of the turbine for deep-sea work is afforded by the successful voyage of the steamship "Loongana," which made the journey from Glasgow to Australia in 30½ days. The details of this trip are found elsewhere in the present issue.

THE CRISIS OF THE RUSSO-JAPANESE WAR.

That the crisis of the Russo-Japanese war should have come and gone without producing so much as a ripple of excitement in the columns of the daily press, is a curious commentary upon the popular estimate of the relative importance of naval events in the Far East. The very columns that were filled with lengthy telegraphic accounts of the torpedo attack of last February, which, after all, merely opened the war, now, in the very hour of the crisis of the war, can find no more than two or three inches of space to record the destruction, in one fell blow, of Russia's naval power in the Far East, and the sounding of the death knell to any reasonable hope of the ultimate success of Muscovite arms.

We showed in a recent article that the defense of Port Arthur, which really meant the defense of the Port Arthur fleet, was the key to the present situation; for it meant the protection and preservation intact of this fleet until it could join hands with the approaching reinforcements under Rodjesvensky. Hence the terrific attacks on 203-Meter Hill, the possession of which by the Japanese would afford implacements for heavy naval guns, capable of commanding the anchorage of the battleships and cruisers that constituted the powerful remnant of the Port Arthur fleet. Unquestionably the struggle for this position marked the crisis of the present war. Had it proved impregnable, Japanese command of the sea, with every thousand leagues of advance of the Baltic fleet, would have become increasingly imperiled, and the command of the sea once lost, the capitulation of Oyama's Manchurian armies (cut off from their base of supplies) would have been merely a matter of time. The Japanese, once in possession of this hill, lost no time in dragging their heavy naval batteries into position, and then commenced what must go down into history as one of the most tragic disasters of any great naval war. There at anchorage lay six modern battleships and cruisers, the very flower of the Russian Asiatic navy, and each representing a money value of from four to six million dollars. Upon the distant hill was a battery of high-powered modern guns, whose gunners, getting the range to a nicety, proceeded to sink the ships in detail. It took but a few hours to send property of a total value of over $30,000,000 to the bottom, and then for several days the high-explosive shells were rained pitilessly upon the helpless ships until they were wrecked beyond any possibility of salvage. The sunken vessels are the battleship "Retvizan;" the battleships "Pobieda" and "Peresviet," sister vessels to the "Osliabya," now forming part of the Baltic fleet; and the battleship "Poltava," sister to the "Petropavlovsk," which, it will be remembered, was sunk early in the war with Admiral Makaroff on board; the fine armored cruiser "Bayan;" and the protected cruiser "Pallada." The "Sebastopol," sister to the sunken "Poltava," being in drydock, escaped the Japanese shells, but was subsequently sunk by Togo's torpedo flotilla at her anchorage outside the harbor.

Now that the Russian fleet has been destroyed, Admiral Togo can send his battleships to Japan for drydocking and general overhauling, leaving his smaller cruisers to maintain the blockade, and prevent the sending in of supply ships. He will have ample time to get his fleet into absolutely first-class condition ready for the advent of the Baltic fleet—that is, if it ever arrives. For the conviction must now begin to force itself upon the Russian Admiralty that the four modern and two old battleships, and the two still older armored cruisers of the Baltic fleet, will be no match for the four battleships and eight armored cruisers, all of the very latest type, which they will have to confront and sweep out of the way, if they are to break down the sea power of Japan and isolate her Manchurian armies from their base.

Were the personnel of the opposing fleets of equal skill, daring and general efficiency, the advantage in material would still lie with the Japanese; but having in view the necessary rawness of the hastily improvised crews of the Baltic fleet, and the lack of *morale* shown in the North Sea incident, it is not conceivable that they can win any victory over the veterans of the Port Arthur blockade, trained and hardened as they will be by more than twelve months of arduous campaigning.

The command of the sea, then, is assured, by all of the laws of probability, to the Japanese, and Russia must now bend her energies to the prosecution of the

campaign on land. There seems to be little to choose between the fighting qualities of the average Japanese and Russian soldier. Both are equally brave and persistent. It is also true that in strategy, Kuropatkin seems to be fully a match for Oyama. Therefore, the issue of the great Manchurian campaign next year will depend chiefly upon the relative ability of the contestants to place men, munitions, and supplies at the front. It will be largely a question of transportation. Can the single-track Siberian railroad, 5,000 miles in length, maintain at the front a larger army than the Japanese with their few hundred miles of transportation over three or four independent routes from Korean and Manchurian ports to the front? This is a vital question which will be answered very soon after the break-up of the severe eastern winter.

TIDAL WATER POWER—MEANS OF OBTAINING A CONSTANT HEAD OF ABOUT THIRTY-EIGHT FEET.

BY W. S. CLEVELAND.

The utilization of tidal water power, owing to its intermittent availability under existing and proposed methods of application, has received but little practical attention, although the immeasurable volume of water subjected to extraordinary tidal action on the Bay of Fundy coasts affords a limitless field for the development of cheap power, and consequent industrial activity, provided this one serious barrier is removable.

The estuaries of the numerous small streams flowing into the bay or its extensive arms are usually bordered by widespreading tracts of marsh lands, drained by winding creeks, and protected from tidal inundation by hundreds of miles of dikes. Some of these lands, without the dikes, would be submerged to a considerable depth at every tide, and, in localities where a creek or small river is available for use as a tailrace discharge basin, a sufficient area of these lands could be inclosed with dikes, provided with sluices, designed to maintain high water in the reservoir formed thereby, and a dam, also provided with sluices, thrown across the creek or river, to exclude the tides therefrom, but with the sluices so adjusted that the tailrace discharge would be drawn off at low tide. The capacity of creeks so used could be enlarged, if necessary, by dredging, and the fresh water flowing into them, if of sufficient volume to be troublesome, could be diverted into other channels, or impounded above a dam, constructed at the upper end of the basin, and also drawn off at low tide, through sluices designed for the purpose. This dam would be inexpensive, as the fresh water would not rise to any considerable height during the few hours between the discharge periods, which would be about four hours in length, or while the tide is out, leaving about eight hours when the low-water sluices would be closed, and a small rise in the water level of the discharge basin incurred. An infinitesimal loss of power, however, would be sustained, in basins suitably proportioned to the work. The capacity of the high-water basin would of course depend chiefly upon its area, and a depth of five or six feet would probably be sufficient. Allowing one or two feet for variations in the water levels of the basins, a head of from thirty-five to forty feet would be available, at points on Mines Basin, which, sustained by the limitless volume of ocean water, replenishing the basins every twelve hours, would afford an aggregate power far beyond the utmost capacity of Niagara.

The estuaries of two contiguous rivers, like the Avon and the St. Croix, could be used in a similar manner, the dam for the high-water basin in the one being provided with sluices, of suitable design and capacity, to supply the water drawn off through a power canal, discharging into the low-water reservoir in the other. These sluices would not need to be more than five or six feet in depth, located in the coping of the dam, and operating during the flooding period—about two hours in length at high tide.

Many of the inlets on Cumberland Basin could be used for the same purpose, the estuary of the Maccan River, and the head of Cumberland Channel, affording an excellent opportunity. In this case a tailrace channel would have to be excavated across Amherst Point, for an outlet from the low-water basin in the Maccan estuary. Single inlets, with narrow entrances, and low-lying shores, could be used for discharge basins, where sufficient land is obtainable, without excessive excavation for the high-water basins. The cost of excavating such basins, to a depth of five or six feet, would doubtless not be prohibitive.

Lands submerged at high water to a depth of fifteen or twenty feet, could be surrounded by embankments, and the inclosed area divided equally for the two basins. The discharge basin could then be excavated or dredged to low-water level, and connected therewith by a tailrace outlet. This work, however, would entail engineering difficulties and considerable cost.

One of the best of opportunities for applying this method of using tidal water power is afforded by the harbor of the city of St. John, N. B. Kennebecasis and Courtney bays are large arms of the harbor, but both, under present conditions, are of little service to shipping. The entrance to the former bay is located above the famous Reversible Falls, but subject to the action of the tides at high water, and the latter is studded with dangerous reefs and rocky flats, which render it worthless to shipping, except at high water. The entrance to Kennebecasis Bay is very narrow, and the embankment making it serviceable as a high-water basin could be cheaply constructed; but the mouth of Courtney Bay is much wider, although not imposing any serious engineering difficulties in the work of converting it into a discharge basin. In applying the thirty-foot head of water thus obtained, the narrow neck of land separating the bays could be crossed by power and tailrace channels, and the turbines located at the most convenient point thereon. Should previously suggested improvements, embodying the maintenance of continuous high water in this harbor, be carried out, a slight modification of the original plans would facilitate the application of this great water power, and make St. John city one of the leading industrial centers of the continent.

At Moncton, a city of about ten thousand people, located on a sharp bend of the Petitcodiac River, a magnificent harbor, of several square miles in area, is created at every tide, beginning with a rushing, boiling, wall of water, about six feet in height—the famous Moncton Bore. The water level rises, at flood tide, to a height of about thirty feet; but at low water, an insignificant streamlet winds through the muddy flats of the river bottom, boiling like a caldron, at intervals, in its passage over dangerous quicksands, and again spreading onto the outer fringes of sandbars, with thick indurated crusts, over which the pedestrian may stroll with safety. A traffic bridge crosses the river at the upper end of the town, the use of which would facilitate the construction of a dam at this point, where the turbines for a great water power would be located, discharging into the low-water basin above the dam, the outlet channel for which should be excavated through the peninsula of marsh land to a point below the river bend, where a dam, provided with flooding sluices, would complete the work necessary for the formation of the high-water basin. The cost of the outlet channel, about two miles in length, through marsh land, only a few feet above high-water level, would be moderate, and, with the rest of the equipment, fully justified, considering the unfailing source of the enormous power that could be developed at this point. A gate, permitting the entrance of shipping at high water, constructed in the lower dam, would remove one of the most serious obstructions to the commerce of the port, which is now restricted to the carriage of small vessels, passing inward with the flood tide, but stranded at the docks when the tide is out. The completion of this work would substitute a beautiful sheet of water in place of the yawning gulf and unsightly mudbanks that now meet the gaze of visitors, who would only have to row to the lower dam to still get a view of the bore.

WIRELESS BURGLAR ALARM FOR SAFES.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

An interesting experiment to demonstrate the possibility of the application of wireless telegraphy to burglar alarms for safes has been carried out by a well-known firm of British safe builders. The ordinary type of electric alarm for this purpose possesses two great disadvantages, which to a very appreciable extent militate against their utility. They either refuse to ring at the critical moment, or they ring suddenly for some inexplicable reason. Furthermore, the expert burglar can always circumvent their usefulness by cutting the wires where the system is the completion of an electrical circuit to produce the alarm or where the current flows constantly through the wires, apparatus, and contacts, and the alarm rings when the circuit is disturbed by joining the wires together and completing the circuit outside the safe. There is another protective system generally adopted in this country, arranged with constant current when on guard, which will give the alarm if the wires be joined so as to produce a short circuit, and thus cut the object which is protected out of circuit, so that the alarm bell will commence ringing, no matter what sort of attempt may be made to tamper with the wires. This latter system, however, is essentially dependent upon the introduction of a fine resistance coil inside the safe or object to be protected. When the wires are tampered with, the effect is to cut out this resistance coil from circuit, and by so doing a galvanometer needle is thrown over from its normal position to make contact for the relay which works the bell.

With an efficient wireless system, however, tampering so as to destroy the efficiency of the apparatus would be impossible. In this arrangement the safe is equipped with a small but efficient transmitter. When the safe is opened waves are radiated, which coming into contact with the usual coherer at some distant central point, ring a bell and so announce the fact that the door has been opened. To effect this, the battery power and induction coil which make the electrical waves are both contained inside the safe, while the steel of which the safe itself is made acts in a similar way with a long wire supported on a high pole, as the antennæ in wireless telegraphy.

The application of the principle to this particular purpose is still in its infancy, but the experiments made up to the present conclusively demonstrate the possibility of its general utilization, provided that satisfactory instruments are used, and careful tests made every now and then to see that all the various parts of it are in proper working order.

The one great drawback to the general employment of this system, however, is the expensive nature of the necessary apparatus, the cost of which varies from $1,000 to $1,500. For the purpose of these tests, however, instruments of a much cheaper description have been employed, so as to roughly enable the experimenters to test the possibility of their application in a general way.

The success of the trial, however, opens every possibility of its successful and widespread utilization, and no doubt a cheaper though equally efficient form of apparatus will be evolved, so as to render the system commercially practicable. Incidentally, it may also be mentioned that the whole of the safe is so charged with electricity that it gives a slight disconcerting shock to anyone who touches it.

SCIENCE NOTES.

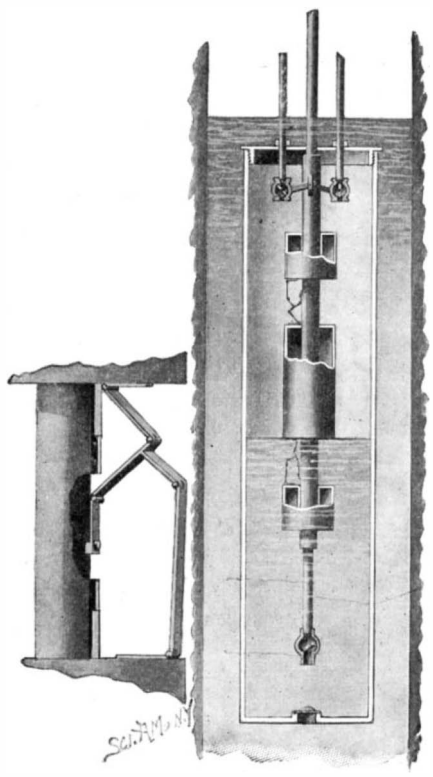
In the Comptes Rendus of the Paris Academy, Mr. Lowell gives the result of a series of spectrographic determinations of the rotation of Venus and Mars. For Venus, the speed of motion of a point on the equator was found to be practically *nil*, the probable error of the observation only amounting to 0.008 kilometer per second, the result thus supporting the idea that Venus rotates in the same period as her revolution. For Mars the speed was found as 0.228, the computed value being 0.241. The probable error in the case of Mars was 0.036. The satisfactory result obtained for Mars lends support to that for the larger and brighter planet.

The recent discoveries of wonderful new types of extinct animals in the tertiary deposits of the Fayum Desert of Northeastern Africa, and their bearing on the origin of the modern African fauna, are discussed by Dr. C. W. Andrews in the Quarterly Review. The new evidence shows unmistakably that the Proboscidea (elephants and mastodons) and the Hyracoidea (the "coney" of Scripture and its relatives) were developed in Africa itself; but it does not appear to invalidate the long accepted theory that the bulk of the modern African fauna is of northern origin. It might, however, have been added that, in view of the discovery of certain antelope and other remains in the later tertiaries of Africa, the migration may have been somewhat earlier than commonly believed. Probably, indeed, there have been several migrations of African types to the north and of European and Asiatic types into Africa. In this connection it may be mentioned that Dr. C. W. Andrews, the chief describer of the extinct Fayum fauna, has brought to notice in the November number of the Geological Magazine a remarkably fine shell of the giant land tortoise, *Testudo ammon*, of the Upper Eocene beds of the district in question. This appears to be the earliest of the big land tortoises, and may have been the ancestral type from which those of Madagascar, Mauritius, and the Mascarene Islands, together with the extinct Indian species, were derived.

The past year has been noteworthy for the amount of literature devoted to the members of the horse tribe, or *Equidæ*, writes R. Lydekker in Knowledge. One of the latest contributions to the subject is an article by Mr. R. T. Pocock, the superintendent of the London Zoological Gardens, on South African quaggas, published in the November number of the Annals and Magazine of Natural History. According to the author, we have to deplore the extermination not of one, but of several distinct forms of these animals; the quaggas of the older writers, of which two races are recognized, being distinct from those exhibited forty years ago in the Regent's Park and other menageries. Without for a moment saying that the author may not be right in his view, it certainly does seem strange that the whole of the quagga-skins which have come down to us should differ from the animals described by the older zoologists. The Asiatic and African wild asses form the subject of a paper by the above writer published in a recent issue of Novitates Zoologicæ, the organ of Mr. Walter Rothschild's zoological museum at Tring; an apparently new race of the "onager" from Central Asia, now living in the Duke of Bedford's park at Woburn, being described and figured. The description of one of the two races of the African wild ass is based on specimens killed in the Eastern Sudan by Mr. N. C. Rothschild, one of which is now mounted in the British (Natural History) Museum, while there is a second in the Edinburgh Museum, and a third in Mr. Rothschild's own collection. As the construction of the Suakin-Berber railway is only too likely to lead to the extermination of this race, these specimens are very precious.

PNEUMATIC PUMP.

We illustrate in the accompanying engraving a rather ingenious type of pump, which is operated by compressed air. The pump consists of a closed chamber, which may be placed in a well below the level of the water. An upwardly-opening valve is provided in the bottom of the chamber, and projecting through the

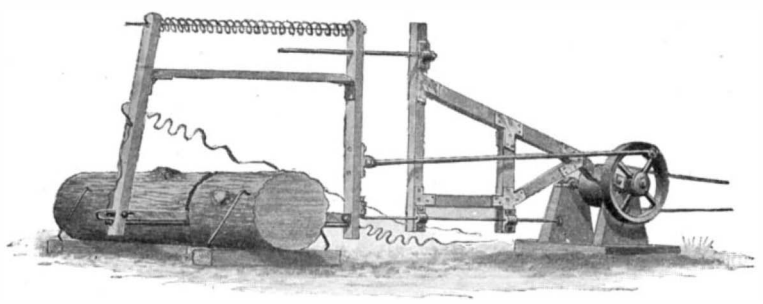


NOVEL PUMP OPERATED BY COMPRESSED AIR.

top is a standpipe which extends nearly to the bottom of the chamber. The standpipe carries a sleeve to which is secured a float. Above and below this float are two smaller supplementary floats, which slide freely on the sleeve. The main float is connected to the standpipe by two pairs of toggle levers, which pass through slots in the sleeve. One pair of toggle levers has lever connection with the upper supplementary float, and the other pair with the lower supplementary float. In addition to the standpipe two other pipes enter the top of the casing, the one at the right being the compressed-air pipe, and the other a discharge pipe which permits escape of the air while the chamber is filling. These pipes are provided with valves, which are operated by the sleeve on the standpipe, the arrangement being such that when the sleeve is up, the compressed-air pipe will be open and the discharge pipe closed, and when the sleeve is down, the discharge pipe will be open while the compressed-air pipe will be closed. In operation, when the air supply is cut off, water will flow up into the chamber through the valve in the bottom. The main float will be kept from rising by the weight of the upper supplementary float, which locks the upper pair of toggle levers. When, however, the water rises sufficiently to raise the upper float, the toggle lock will be broken, releasing the main float, which will rapidly and forcibly rise, carrying the sleeve up, and thereby opening the valve of the compressed-air pipe and closing that of the discharge pipe. The inflowing air will now force the water out of the chamber and up the standpipe. In the meantime the main float is kept from dropping by the buoyancy of the lower float, which holds the lower toggle levers in locked position. When, however, the level of the water falls below the lower float, the latter will drop, tripping the toggle, and permitting the main float to fall also. This reverses the position of the valves in the compressed air and discharge pipes, and permits the chamber to fill up again. The operation is then repeated. Some of the principal advantages of this pump are that when there is a small supply of water, it will pump all of it out as fast as it runs in; several wells can be run from one power by connecting air-supply pipes thereto, and the power need not be at the well, but wherever most convenient. The inventor of this pump is Mr. E. Hastain, at Tishomingo, Indian Territory.

ELECTRICAL APPARATUS FOR FELLING TREES.

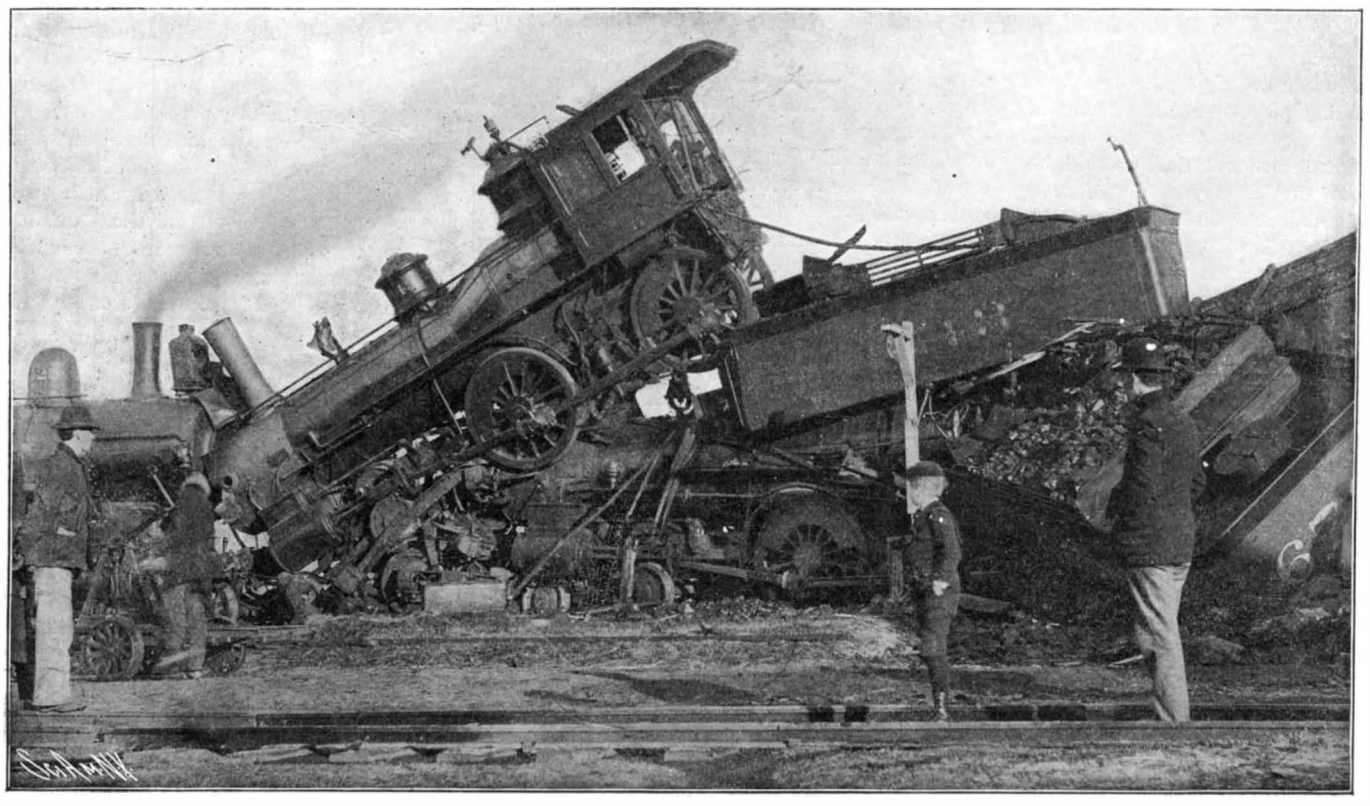
A patent has recently been granted to Mr. T. O. Wilson, of Little Rock, Ark., on an electrical apparatus for felling trees and sawing logs. In place of a saw blade, this apparatus uses a platinum wire which is heated to a high temperature by an electric current, and this burns its way through the wood. The apparatus comprises a frame similar to that of a buck saw, across the lower end of which the resistance wire is stretched. The tension of the wire may be adjusted by a bar which extends between the side arms of the frame, and is clamped at one side by a thumb screw which passes through a slot in the bar. The upper end of the frame is provided with a coil spring adapted to draw the side arms together, to take up the slack in the resistance wire as it expands when heated by the current. Since ashes are apt to collect in the kerf and retard the burning of the wood, the inventor has provided a mechanism for reciprocating the saw frame. Furthermore, the resistance wire may also be wound with a short length of platinum wire, and the coils of the latter will act as drag teeth to remove the fine ashes and clear out the charred fragments. The mechanism for reciprocating the saw frame, which is clearly depicted in the engraving, may be driven by an electric motor. The apparatus offers the advantage that it may be operated at long distance from its source of power, thus giving it a wide radius of action. The inventor has designed the apparatus particularly for the use of lumbermen in felling trees. The electric saw permits of cutting off the trees very close to the ground, and at a much smaller expenditure of labor than with the usual hand-operated saw.



SAWING LUMBER WITH AN ELECTRICALLY-HEATED WIRE.

DESTRUCTIVE HEAD-ON COLLISION.

It is not often that one sees the destructive effect of a head-on collision between freight trains so graphically portrayed as it is in the accompanying illustration. The wreck occurred at Colo, Story County, Iowa, on the Chicago and Northwestern Railway, before daylight on a frosty and very foggy morning. The station lay at the foot of a heavy grade, and, at the time of the accident, a long freight train had just pulled in from the west, and was standing on the main track, the engine being near the depot building. A double-header train coming in from the east was intending to take the side track in order to allow the two trains to pass. For some reason or other, the brakes failed to work, and, the train failing to take the switch, the collision occurred. The engine at the head of the standing train remained on the track, only the forward trucks being displaced, and after the collision it was able to be removed under its own steam when the wreck had been cleared away. Of the two engines shown one above the other in our engraving, the one above was the leading engine of the pair at the time of the collision. The second engine, driven by the momentum of the train behind it, wedged its way under the tender ahead and was crushed under the forward engine, which it lifted up on end. The illustration gives forcible evidence of the great resisting power of a modern locomotive under the enormous strains and impact to which it is subjected in a wreck of this kind. We are indebted for our information and photograph to Mr. G. A. Fox, of Zearing, Iowa.



A DESTRUCTIVE HEAD-ON COLLISION IN WHICH THREE LOCOMOTIVES FIGURED.

Bovine and Human Bacilli Found to Be Distinct.

The Imperial Commission of consumption experts appointed by the German government some time ago to investigate the relations between bovine and human tuberculosis bacilli held an important meeting at the Imperial Health Department in Berlin, November 25. Dr. Weber, one of the most eminent members of the commission, reported on the work which that body has already done. The result of the investigations so far is to show that bovine and human bacilli are absolutely distinct biologically from one another. The one never develops or changes into the other.

So far the commission has examined the bodies of fifty-six persons who died from tuberculosis. In fifty cases only human bacilli could be discovered. In six cases, however, the bovine bacillus was found. Three of these cases were young children, and the surmise is permissible that they received the bacillus from the milk of a diseased cow. Two other cases which Dr. Weber regards as most important are those where the corpses showed bovine bacilli in the glands and human bacilli in all other portions of the body. These were distinct cases of double infection. Another most important case is one of lung tuberculosis, where in the diseased lung both bovine and human bacilli were associated.

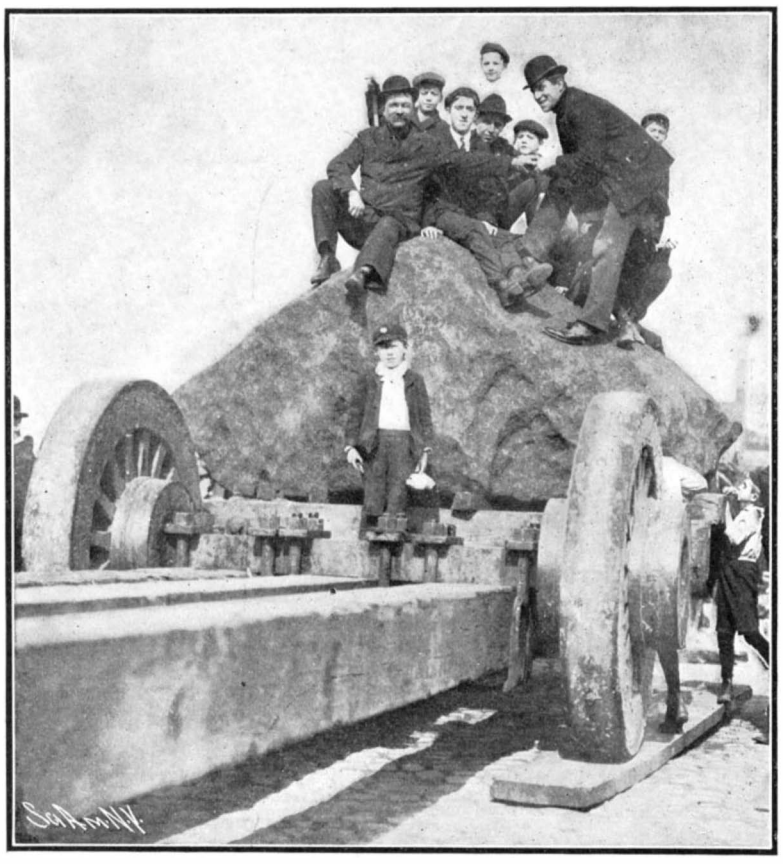
The conclusion of the commission, in general terms, is that tuberculosis in human beings is caused by the human bacillus, but that it behooves us to be careful and to use all prescribed measures to secure ourselves against infection from bovine bacillus.

An interesting commercial development, to test the possibilities of steam lorries for collecting and distributing heavy traffic in remote agricultural districts in connection with railroads, has been made in the district of York, by the North-Eastern Railroad in conjunction with the Agricultural Organization Society on behalf of the Brandsby Dairy and Trading Association. The railroad authorities have established a service of motor-cars between their station at Tollerton, ten miles north of York, and Brandsby, eleven miles from Tollerton. The cars will run in each direction daily. Each steam lorry has a carrying capacity of five tons of freight, and is capable of hauling at least one trailer carrying two and a half tons. On the outward journey the lorry carries limestone, provisions, etc., and distributes the same around the various farms in the district. Simultaneously, the cars collect any produce that is to be forwarded by rail. By this system not only is transport facilitated, but the farmers in districts distant from the railroad are brought into closer contact with the markets, and the service will prove a considerable saving to them in the cost of haulage. If successful, similar services will be inaugurated elsewhere.

A NEW HOME FOR THE PEARY METEORITE.

BY WALTER L. BEASLEY.

Ahnighito ("The Tent"), the giant meteorite discovered by Lieut. R. E. Peary in Greenland in 1894, has been removed from its rather secluded position on Cob Dock, in the Brooklyn navy yard, and more strikingly exhibited on a mounted pedestal under the entrance arch of the Museum of Natural History, the two lesser ones (the "Woman" and "Dog"), companion meteorites found at the same time, having been previously installed in the interior. According to the legendary records of the present natives these three masses were originally an Innuit woman, her dog and tent, who were hurled down from the sky by the evil spirit. On account of the extreme high latitude in which the meteorite was found, namely, Melville Bay, thirty-five miles east of Cape York, North Greenland, coupled with its great size, uncontrovertible celestial origin, and the human associations surrounding the same, Ahnighito can be fittingly classed as the world's largest and most famous meteorite which has so far fallen on the earth's surface and been weighed. Its nearest rival is Bacubirito, of the State of Sinaloa, Mexico, whose weight has not yet been determined, but which, however, is conjectured to be far below the tonnage of Ahnighito. The new position of the noted meteorite displays its size and shape to marked advantage, the size rendering it conveniently accessible to the general public and scientists for examination. While it required many weeks of patient and laborious work for Lieut. Peary and his band of Eskimo helpers, with limited tools, to dislodge the mighty mass from its position of centuries in the Polar world and to safely get it into the hold of the "Hope" for its long voyage to civilization, the second moving of Ahnighito, measuring eleven and a half feet in length, seven feet six inches wide, six feet thick, and tipping the scales at thirty-seven and one half tons, was, with the aid of up-to-date appliances, speedily conveyed and set down in its new home in a day's time. At the foot of West 50th Street, North River, a wrecking barge, with a huge derrick, brought the meteorite from the navy yard and swung it upon the contractor's wagon, drawn by twenty-eight horses. The transportation charges on this precious mass amounted to over $500. The big meteorite is of especial scientific interest insomuch as its genuineness has been passed upon by the most celebrated experts of Europe. Fragments were sent to Profs. Fletcher, of the British Museum, Weinschenck, of Munich, Brezina, of Vienna, also Prof. Salisbury, of the University of Chicago. These high authorities pronounce the pieces examined to be of extra-terrestrial origin and belonging absolutely without doubt to a meteorite, as the topography of the surfaces examined in detail possess all the distinctive characteristics which mark the heavenly bodies and are not found in any other stones or metallic masses on the earth's surface. The analysis by Prof. Whitfield of the American Museum showed that it contained 91 per cent of iron and 7 per cent of nickel. The color is a dark brown or bronze. One side is wedge-shaped, the opposite tabular. When discovered it was sunk in the earth with the wedge side down. According to Prof. Salisbury, a member of the Peary expedition, the meteorite evidently fell on glacier ice, when ice covered the whole region where it lay. On the melting of the ice the meteorite was let down upon the surface in the position where it was found, half buried. It is thought that a considerable portion of the meteorite has been removed by chipping off the fragments by successive generations of primitive natives in fashioning their crude implements for hunting land and sea-animals, their only chance for subsistence. Thus the big meteorite has been of great economical value to an entire aboriginal tribe isolated for centuries from civilization, the most northerly and smallest upon earth, whose habitat is entirely barren of metal.



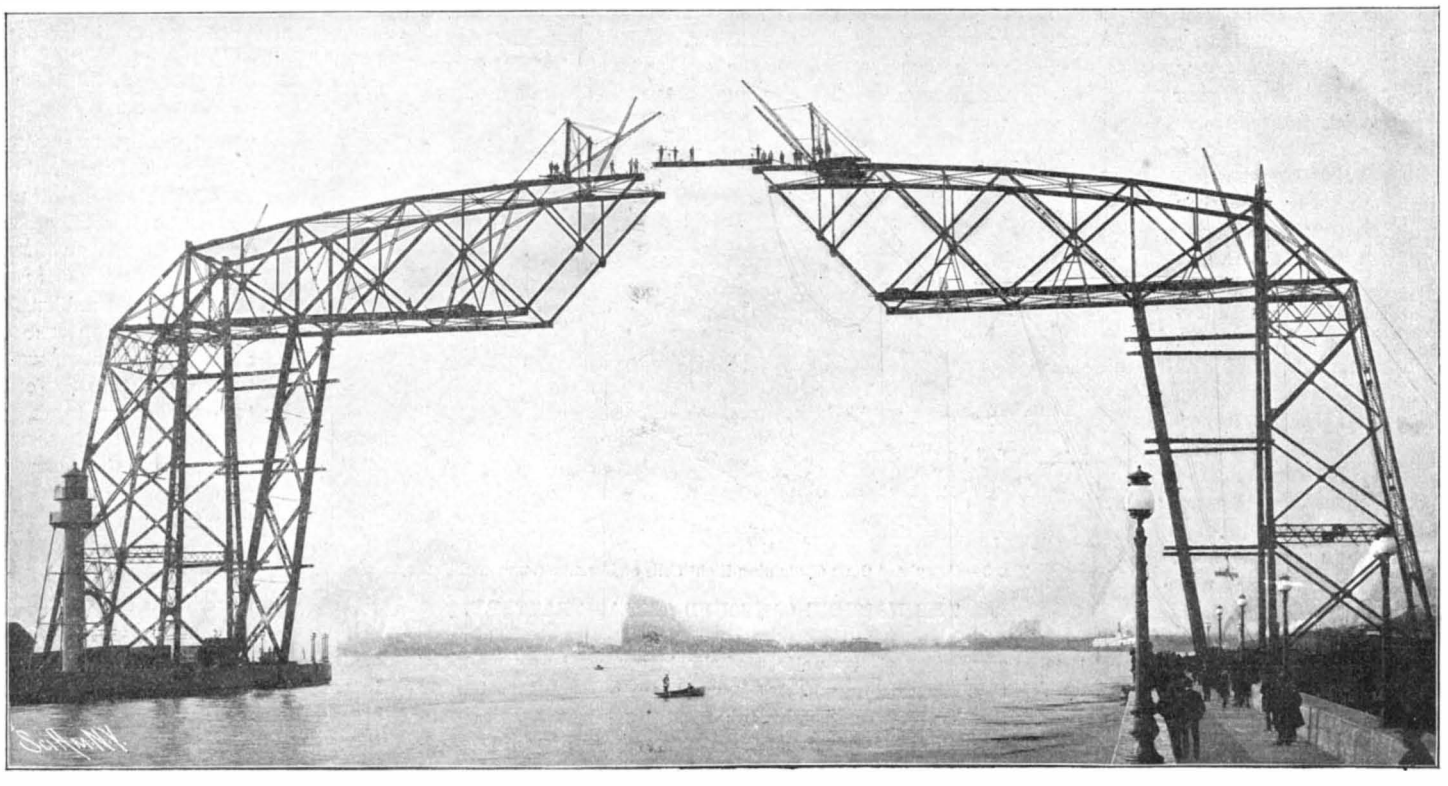
REMOVING THE PEARY METEORITE TO THE AMERICAN MUSEUM OF NATURAL HISTORY.

For hundreds of years prior to the advent of white communication the natives obtained their scanty iron supply for knives, hatchets, harpoons and arrow-heads from their iron mountains. Piles of blue trap rocks used by them in pounding off fragments of their god for making their weapons were found near by. Several of these interesting relics, so closely associated with the big meteorite, were brought back by Lieut. Peary among the Eskimo collection of the Museum.

THE AERIAL BRIDGE AT DULUTH.

The unusual form of bridge shown in our illustration will possess decided novelty to American eyes, for it is the first of its kind to be built in this country. It was erected in accordance with an agreement for perpetual free ferry service made by the city of Duluth in consideration of a grant of right of way for the United States ship canal at that port. For many years, two old-fashioned flat-boats plied half-hourly between the two landing points; but as the canal widened, this primitive mode became extremely inconvenient, not to say dangerous, and tugs were hired to take their place. With each succeeding year the expense increased, and the perpetual ferry began to loom up before the city fathers as quite a leading question. Numerous alternative plans were discussed, and for one reason or another abandoned. The estimated cost of a tunnel—about one million and a half dollars—rendered that form of communication out of the question, and the War Department refused to allow a drawbridge of any kind. One of the mayors of the city, however, had seen and been much impressed with the aerial bridge which was opened a few years ago at Rouen, France; and its applicability to the conditions at Duluth was so apparent, that this type was readily adopted. The present bridge was planned on the principles of the Rouen structure, and it will no doubt prove to be a satisfactory solution of the problem. Although the structure will be the first of its kind in America, it is not by any means novel in the engineering world, as there are in Europe to-day three bridges of the same general type: The one mentioned at Rouen, France, over the Seine; another at Pt. Egalite, Spain; and the third at Bigerta, Tunis.

The bridge at Duluth, as will be seen from our engravings, is a decidedly imposing structure. It consists of two piers or towers on shore, supporting a deep truss which spans the open waterway. There is nothing special in the details of this work, the piers being of the standard type used in steel railway viaducts, the truss being of the usual American design with long panels and single intersections. The posts are vertical on the side facing the channel, the other two posts on the land side being battered to give the necessary stability. In the erection of the structure the piers were first built to their full height, and then the trusses were erected by the overhang method, a temporary timber bent being used to support the first panel of the truss, and the rest of the overhang being erected from traveling derricks mounted upon the top chords. At the time our photograph was taken the last section of the top chord was being lifted into place by the derricks. From the water-line to the bottom of the trusses is 135 feet, and as the truss is 50 feet deep, the highest point is 185 feet above the water. The clear span between towers is 381 feet 6 inches. Special attention was given to wind pressure, the bridge being built to withstand a wind velocity of seventy miles per hour blowing transversely to the axis of the bridge. The traveling car will be suspended from the lower chords by stiff cables, and its floor will be 12 feet above the water level. The distance between landing points will be made in one and one-half minutes, and the schedule for trips will be arranged by the War Department soon after the completion of the bridge. The car measures 20 feet by 30 feet, and it has a capacity of 65 tons. The total cost of the structure will be about $110,000.



Clear Span, 381½ Feet. Depth of Truss, 50 Feet. Clear Height Above Water, 135 Feet.

Travel will be by means of a suspended car hung from the bottom chords of the truss.

THE NEW AERIAL BRIDGE ACROSS THE SHIP CANAL AT DULUTH.

The French Admiralty recently carried out an interesting experiment to ascertain whether the explosion of a torpedo in the vicinity of a submarine exercises any injurious effect upon another torpedo lying alongside the vessel. The submarine anchored off Cape Petet, and the torpedo, containing a charge of 100 kilogrammes of gun cotton, was fired at a distance of 50 meters from the submarine, beside which, exposed to the full force of the exploding torpedo, was placed the second weapon. Not the slightest damage was caused by the explosion.

Statistics of the American Iron Trade.

One of the most important and interesting of the statistical papers published annually by the United States Geological Survey is a review of the American iron trade. The report for 1903, like those of many preceding years, was prepared by Mr. James M. Swank, general manager of the American Iron and Steel Association, and contains a great variety of data regarding the production and shipments of iron ore; the imports and exports of iron and steel; the average monthly and yearly prices of iron and steel and articles manufactured from them; the production and consumption of pig iron; the production of spiegeleisen and ferromanganese; the production of all kinds of steel, as well as the numerous articles, such as castings, rails, wire rods, wire nails, plates, and sheets, which are made from steel; the Canadian iron trade; and the world's production of iron ore and coal, of pig iron and steel.

The prosperity which characterized the iron trade of the United States from the beginning of 1899 to 1902 and throughout the early part of 1903 was suddenly checked about the middle of 1903 by a sharp reaction in the stock market, which caused a decline in the demand for iron and steel and a consequent decline in prices. Production during the first half of the year was on a large scale, and prices were satisfactory, but in the last half of the year both production and prices declined rapidly. Soon after the beginning of the year 1904, however, there was a revival of activity in production, but prices did not rally. In October, however, the prices of pig iron advanced. During September and October there was a distinct revival of confidence and hopefulness in the iron trade, and by the time Mr. Swank's report was written, in the latter part of October, there were few signs of the reaction which began a little more than a year before.

Mr. Swank's tables of statistics show that the world's production of iron ore during 1903 amounted to 100,900,000 tons, of which the United States claims 35,019,308 tons. The world's production of coal and lignite amounted to 870,498,000 tons, of which 319,068,229 tons belonged to the United States. The world's production of pig iron in 1903 amounted to 46,420,000 tons, to which the United States contributed 18,009,252 tons. The world's production of steel during the same year amounted to 35,510,000 tons, of which the United States produced 14,534,978. It is thus seen that in the production of iron ore, coal, pig iron and steel—all great factors in the world's material progress—our country is the leader. We produce 34.71 per cent of the world's iron ore, 36.65 per cent of its coal, 38.80 per cent of its pig iron, and 40.93 per cent of its steel.

The Current Supplement.

The current Supplement, No. 1512, opens with a splendidly illustrated article by the English correspondent of the Scientific American, on the battleship "Dominion," which forms one of the "King Edward VII." class. Mr. Joseph Hollos writes on simultaneous telegraphy and telephony. An excellent discussion of the limitation and the use of storage batteries is presented by H. M. Hobart. The last installment of the exhaustive series on "Current Wheels: Their Use for Lifting Water for Irrigation" is published. Taken as a whole this series of articles may be considered by far the most important monograph of the construction and operation of current wheels that has so far appeared. Commander Peary's paper on the North Polar explorations is continued. "On the Modern Reflecting Telescope and Making and Testing of Optical Mirrors" is the title of a series of articles from the pen of Prof. G. W. Ritchey, the first of which appears in the current Supplement. The papers will describe the methods employed by Prof. Ritchey in the optical laboratory of the Yerkes Observatory in making and testing spherical, plane, paraboloidal, and hyperboloidal mirrors. The subject is very thoroughly discussed. The treatise will be followed at an early date by an excellent paper of Prof. Draper's on the making of a 15-inch telescope. There has recently been installed in the McKeesport plant a new 40-inch universal slabbing mill, which is remarkable for its size and some novel features introduced into its construction. The mill is worthily treated in a well illustrated and fully descriptive article. The usual Trade Notes and Recipes, Engineering Notes, Science Notes and Selected Formulæ are given.

Catlinite is the name given to an indurated clay rock once used by the Dakota Indians for pipe material. It is also called Indian pipe-stone.

THE HASCHKE COMPOUND STORAGE BATTERY.

The illustrations shown herewith give a good idea of the construction and method of assembling the plates of a compound or multiple-series storage battery, which has been patented and put into practical use by Mr. J. E. Haschke, of Chicago, Ill.

The idea the inventor had in mind in designing this battery was to economize in weight and space as much as possible, and at the same time construct a battery

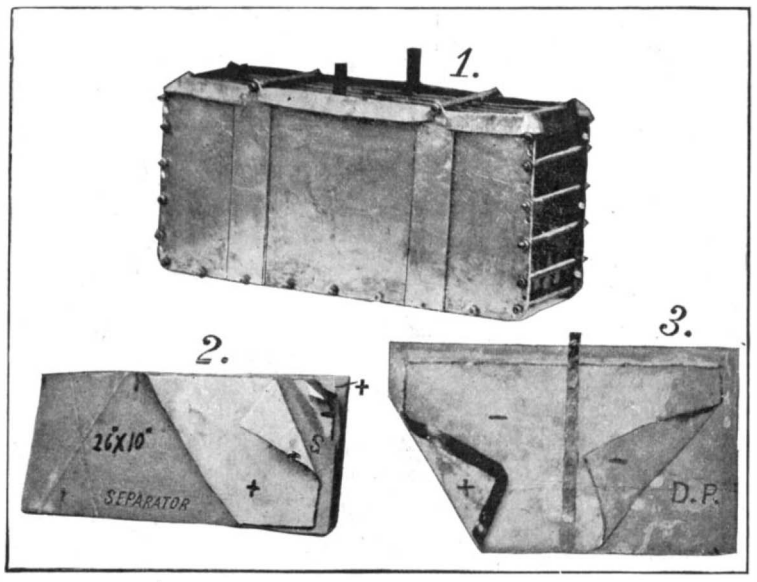


Fig. 1.—1. Compound Battery Assembled. 2. Plates Arranged in Pasteboard Separators. 3. Division Plate with Positive and Negative Plates Attached on Opposite Sides.

of great efficiency and durability which would be suitable for all kinds of automobile work. He had already developed a plate and form of separator which practical tests in electric automobiles had shown to work well, so that his present invention consists in a method of assembling these, or, indeed, the plates and separators of any standard type of storage cell.

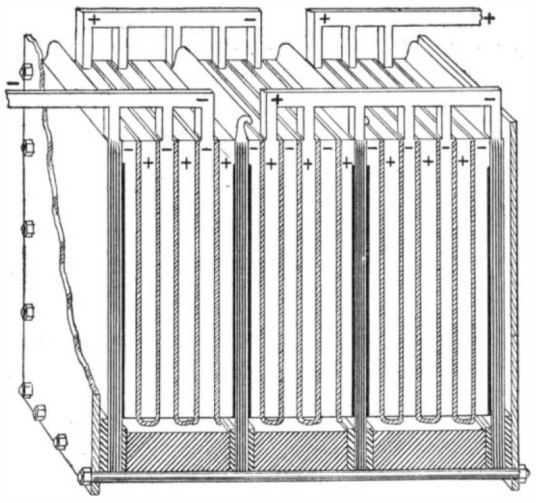


Fig. 2.—Diagram Showing Method of Assembling Battery.

The Haschke plate, as constructed and used for the past eight years, consists simply of a thin sheet of pure lead highly perforated with holes about one-twelfth of an inch in diameter, these holes being filled with the usual paste of red lead or litharge for the positive or negative plates respectively. Such plates are highly flexible, and, although the tendency of the active material to cause them to buckle is slight because of the smallness of the pellets of the latter, still any warping that does occur will not harm them on account of their flexibility. The separator used by Mr. Haschke consists of a specially-treated envelope of thin cardboard, which completely incloses the plate and thus tends to keep the active material from falling out. After being treated by exposure to certain gases engendered by electrolysis, this thin cardboard, when placed in the sulphuric acid solution, becomes as tough as leather while remaining porous. It has to be renewed after three years' use, owing to its disintegrating on the top edges, where the air gets at it. If kept completely submerged, it will last longer.

The new compound battery is made up of several individual cells consisting of U-shaped hard rubber frames clamped between thin lead plates. Rubber gaskets are used in order to make acid-tight joints. Any suitable number of cells may be arranged in this way, and as many plates may be placed in each cell as it is made wide enough to receive. Mr. Haschke, on account of the extreme thinness of his plates and the compact manner in which they are assembled (see Fig. 1, No. 2), gets as many as six plates in a cell ¾ inch wide; and, as these plates can be made as long and as high as the space in the battery compartment will permit, a very large active surface can be obtained. The division plates forming the side walls of the cells serve as current conductors and as supports for the end plates of adjoining cells, which are soldered to the division plate across the top. In Fig. 1, No. 3, *D P* is a division plate with a negative plate soldered to one side and a positive plate to the other. As all the positive plates of any one cell are connected together, and all the negative plates are likewise connected, it follows that since all the positive plates of a cell are connected to the positive plate on one side of a division plate, and all the negative plates of the next cell are connected to the negative on the other side, the positives of one cell are all connected to the negatives of the one following *through* the division plate. This makes unnecessary the connecting lugs between cells which are ordinarily employed, and thus reduces the resistance of the circuit considerably. In practice, however, the inventor lead-burns the lugs of the positives of one cell to those of the negatives of the next, arching them over the division plate and also attaching them to it, as shown in Fig. 3. The division plates are brought up an inch or two above the plates proper, and they are curved so as to avoid splashing and to afford sufficient surface to prevent leakage of current. The diagram, Fig. 2, shows the arrangement of the plates proper and the division plates. The division plates are here shown clamped between the U-shaped hard rubber pieces by means of rubber gaskets and bolts passing through steel end plates. The appearance of the battery when finished is shown in Fig. 1, No. 1. It is afterward placed in a crate and covered with plates of glass. Such a crate, containing eight cells, is shown in Fig. 3. An 80-volt, 200-ampere-hour battery weighs, according to the inventor, about 850 pounds, which is extremely light for a battery of this capacity, while by doing away with the usual hard rubber jars the chance of leakage from breakage or defect is reduced. The compound battery can be filled with electrolyte in a few moments, and all the cells can readily be inspected through the glass covers, or the electrolyte can be tested after the cover glasses have been removed.

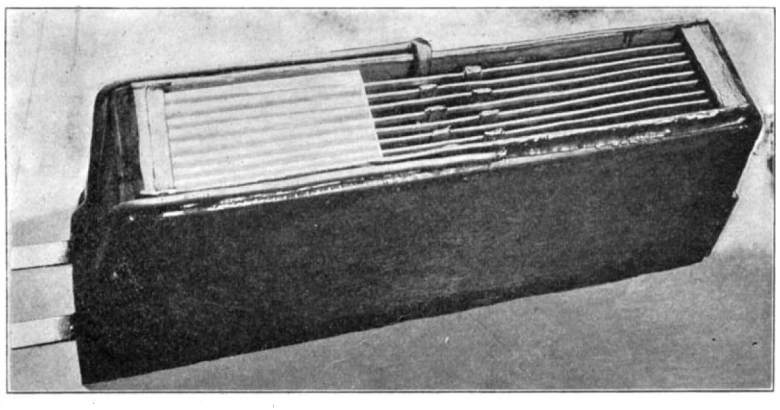


Fig. 3.—Completed Crate Containing Eight Cells of Haschke Compound Battery.

THE HASCHKE COMPOUND STORAGE BATTERY.

The "hole interrupter" invented by Prof. Simeon was designed with a view to utilize the Joule heat for interrupting an electric current. As, however, Mr. Johnson, in the course of his experiments recently presented to the French Academy of Sciences, has convinced himself, the working of this instrument, so far from being due to the Joule heat, is to be ascribed to causes quite foreign to any heating effect. Now Mr. Johnson has tried to construct an interrupter that would really be actuated by Joule heat. A reversed funnel, the pipe of which was 7 millimeters in diameter and 10 millimeters in length, was glued to the lower part of a cylinder 75 millimeters in diameter. The vessel thus formed was immersed in a tumbler filled with a mixture of alum solution and sulphuric acid. Two aluminium plates were inserted as electrodes, one into the cylinder and the other into the outer tumbler, and connected to the terminal of a 110-volt battery. On completing the current, a vapor bubble was formed in the funnel pipe, escaping into the inner cylinder, where it was rapidly condensed. The circuit is opened when the bubble forms in the pipe, and closed on its escaping into the cylinder. The current then forms another bubble, which in turn rises into the cylinder, and so on. This interrupter possesses the drawback of working rather slowly (its frequency being smaller than the Foucault interrupter); on the other hand, it affords the advantage that it is independent of the dimensions of the metallic circuit, even in case there are no inductive coils or solenoids, whereas the Wehnelt and Simeon interrupters require a self-induction that is susceptible of variation only within rather narrow limits.

Correspondence.

Indian Summer.

To the Editor of the SCIENTIFIC AMERICAN:

I was much interested in a late article on the cause of the "Indian Summer." Also in a note from a Southern correspondent.

I spent thirty-five years in western New York and the past six years in South Carolina on the Santee River. The fall here is quite the opposite of the "Indian Summer" of the North. Day after day the air has that crystal clearness that is sometimes seen in the North the morning following a thunder storm. I have noticed this and enjoyed it every fall of my stay here. I write this, as it seems to me to confirm the theory of the "Indian Summer" as noted by your correspondent.

The blue haze spoken of in your note from the South is the drawback to sightseeing in the North Carolina mountains, at all times of the year, as I have found from experience, and not peculiar to the fall. E. J. HUTCHINSON.

Ferguson, Berkeley Co., S. C., December 13, 1904.

Mosquito Extermination.

To the Editor of the SCIENTIFIC AMERICAN:

In a recent issue of your valuable paper there was a notice of a national meeting to be held in New York and Brooklyn, in regard to the extermination of mosquitoes. I would suggest the following plan for the distribution of crude oil into the haunts of these pests: Papier-maché bombs are loaded with crude oil with a small time fuse and small quantity of explosive in the interior of the shell, which bursts them at any predetermined distance, scattering the oil over a large surface and in inaccessible places where a force pump or spray would not cover. These shells can be fired from mortars similar to those used in pyrotechnic displays. This, it seems to me, would be a very simple and inexpensive way of covering a large territory. F. A. DOBSON.

New York, December 10, 1904.

Boilers in the United States Navy.

To the Editor of the SCIENTIFIC AMERICAN:

I trust I am early enough to have a correction made in this week's issue of a statement contained in your very interesting editorial of the 3d instant, descriptive of the trial of the "Pennsylvania."

Wholly in the interests of fair play I call your attention to the erroneous impression conveyed by that part of your reference to changes in the machinery of the "Pennsylvania," in which you state: "The battery of thirty Babcock & Wilcox boilers was replaced by a battery of thirty-two modified Niclausse boilers."

While naval officers are about the most conservative critics in the world, it so happens that the innuendo inferentially cast on the Babcock & Wilcox boiler by the above note touches their pride in the wonderful efficiency and durability of that particular type. This, backed by years of experience with it, and by unimpeachable data indicating an economy unexcelled by any other type, makes the reflection (which I am sure was inadvertent) particularly unfortunate, especially as the other type, however excellent, has yet its reputation to make by long service in our navy.

It is also true that the results of the trial of the "West Virginia," while less gratifying than those of the "Pennsylvania," were in no degree attributable to the difference in the boiler plants.

I have, therefore, simply to request that you will so modify your article as to state the fact that Babcock & Wilcox boilers were never designed by the department for the "Pennsylvania." The department simply specified water-tube boilers of straight tube type, and the Cramps, simply in this case, decided upon the Niclausse.

Very truly yours,
A. B. WILLETS,
Commander, U. S. Navy.

Philadelphia, Pa., December 7, 1904.

[We take much pleasure in inserting Commander Willets' letter, for we certainly had no intention of casting reflection upon any particular type of boiler. The use by the builders of a certain make of boiler, in preference to another that is commonly installed in our battleships and cruisers, was mentioned merely as being one among several points of difference in the motive power of the two sister ships.—ED.]

Firing Tests of the Brown Wire Gun.

The 6-inch Brown wire gun which was illustrated and described in our issue of May 7, 1904, is now at Sandy Hook, undergoing its acceptance trials by the Army Board. Up to the present 7 rounds out of the total of 250 have been fired, with powder charges varying from 32 to 64 pounds, and the results are decidedly promising. The first three rounds of 32, 48 and 58 pounds of powder were what might be called warming-up rounds, and with the last-named charge a velocity of 2,879 feet per second was obtained at 150 feet from the muzzle, with a powder pressure of 28,500 pounds to the square inch. In the sixth round, with a charge of 64 pounds of powder, the velocity was 3,174 feet per second, at 150 feet from the muzzle, with a chamber pressure of 37,060 pounds to the square inch, and a recoil of only 18¾ inches. The gun gives every promise of reaching its estimated velocity of 3,500 feet per second with 42,000 pounds pressure in the powder chamber.

New Expeditions for the Observation of the Total Solar Eclipse of August 30, 1905.

BY MARY PROCTOR.

The great astronomical event of the coming year (1905) will doubtless be the total solar eclipse of the sun, August 30, already referred to in the SCIENTIFIC AMERICAN for August 20, 1904. Plans are now being formed with regard to eclipse expeditions, the choice of observing stations being specially favorable. Several well-equipped expeditions will probably be sent from this country and Europe.

Mr. William H. Crocker, of California, has generously offered to defray the expenses of expeditions to be sent from the Lick Observatory to Labrador, Spain, and Egypt, and the provisional programme for the three stations is, in the main, as follows:

In Labrador, a photographic search will be made for intramercurial planets, in a region of the sky 8½ deg. wide, extending in the direction of the solar equator from 4 deg. below the sun to 15 deg. above it. It has been thought likely that there may be one or more planets between the orbit of Mercury and the sun, and during a total eclipse they would become visible, if ever. On the whole, however, the observations so far made negative the existence of any body of considerable size in this region, though in 1878 Prof. Watson and Mr. Swift, it was thought, had discovered one, if not two, such planets.

In an article contributed by Prof. W. W. Campbell, of the Lick Observatory, to the Popular Science Monthly, for June, 1904, he writes: "The eclipse of August 30, 1905, will occur when the earth is seven degrees from the plane of the solar equator. It will therefore be advisable to search over a region of considerably greater width than was the case in 1901. Inasmuch as increased area means increased instrumental equipment, expense, and difficulty, a corresponding shortening of strip to be observed would perhaps be justified. It is to be hoped that observing parties well equipped for the intramercurial search will be located in Labrador, Spain, Tunis, and Egypt. If clear weather prevails at any of the four stations, very valuable results may be secured. Should a new planet be observed at three such stations, the enormous interest attaching to its discovery would be heightened by the fact that its approximate orbit could be determined at once. If no planets are revealed on first-class plates, the negative result would be scarcely less valuable, though certainly less interesting, than positive results; and the intramercurial question would cease to be a pressing eclipse problem."

Owing to the generosity of Mr. Crocker, a photographic search for intramercurial planets will be made not only in Labrador, but in Spain and Egypt as well. In Spain the photographic intramercurial search will cover a region of 9¼ deg. wide, extending in the direction of the solar equator from 14 deg. below to 14 deg. above the sun. In Egypt the photographic intramercurial search will cover a region of 8½ deg., extending in the direction of the solar equator from 4 deg. below to 15 deg. above the sun.

Photographs of the corona by means of a camera of five inches aperture and forty feet focus, of the form first used by Prof. Schaeberle at the eclipse of 1893, will be made at Labrador, Spain, and Egypt. The large-scale coronal photographs made by Schaeberle at that eclipse opened a promising way for determining an explanation of the changing form of the corona, and whether the coronal streamers are moving in or out, or both, or neither, a question that has not yet been satisfactorily answered. Photographs of the corona should be secured for this purpose at widely-separated stations; and the circumstances of the widely-separated stations in Labrador, Spain, Tunis, and Egypt seem admirably adapted for solving this most important problem at the coming eclipse.

In Spain, a study will be made of the polarized light in the corona. These observations with the polariscope are for the purpose of determining the relation between the reflected and intrinsic light, and perhaps the size of the reflecting particles which are distributed through the corona.

The expedition in Spain will also be provided with spectrographs with moving plate-holders, which will be used to obtain a continuous record of changes in the spectrum of the sun's edge at the time of second and third contacts; and other spectrographs for determining the wave-length of the green coronal bright line, and, if possible, the wave-lengths of the bright and dark lines in the isolated spectrum of the sun's edge, as nearly as possible at the time when the dark lines give way to the bright ones, and *vice versa;* and of a spectrograph for recording the general spectrum of the corona.

This is merely an outline of the programmes for the three eclipse expeditions to be sent from the Lick Observatory, California, to Labrador, Spain, and Egypt, respectively. The details of the programmes have not yet been fully worked out, but will be announced later.

The Yerkes Observatory will not send any expedition to observe the total eclipse next August, but the Naval Observatory, Washington, D. C., will probably send three expeditions, one of which may be located near Burgos, in Spain.

Prof. E. C. Pickering, of the Harvard College Observatory, Cambridge, Mass., states that there will be no official expedition from the observatory. However, Mr. L. W. Ripley, of Hartford, Conn., intends to conduct a party under the auspices of a local amateur scientific society.

An expedition composed largely of amateurs will go to Burgos, Spain, which is probably one of the most desirable stations along the route of anticipated darkness. A programme is being arranged for covering the minor details of an eclipse, such as observations of the diminishing sunlight; the peculiar shadows cast by the foliage on the ground when the sun is nearly eclipsed; the strange wavering lines or shadow-bands, as they are called, which make their appearance a few moments before totality; the swift onrush of shadow; and finally the glorious but indescribable corona.

Thus, while the astronomer is absorbed in special details which require his whole and undivided attention, the amateur enjoys the opportunity of watching the unfolding glories of the corona from the standpoint of a poet or artist. Words fail to convey the impressiveness of the scene (which has been witnessed by the writer on two occasions), and from remotest times it has been described with enthusiasm, as being one of the most beautiful of natural phenomena.

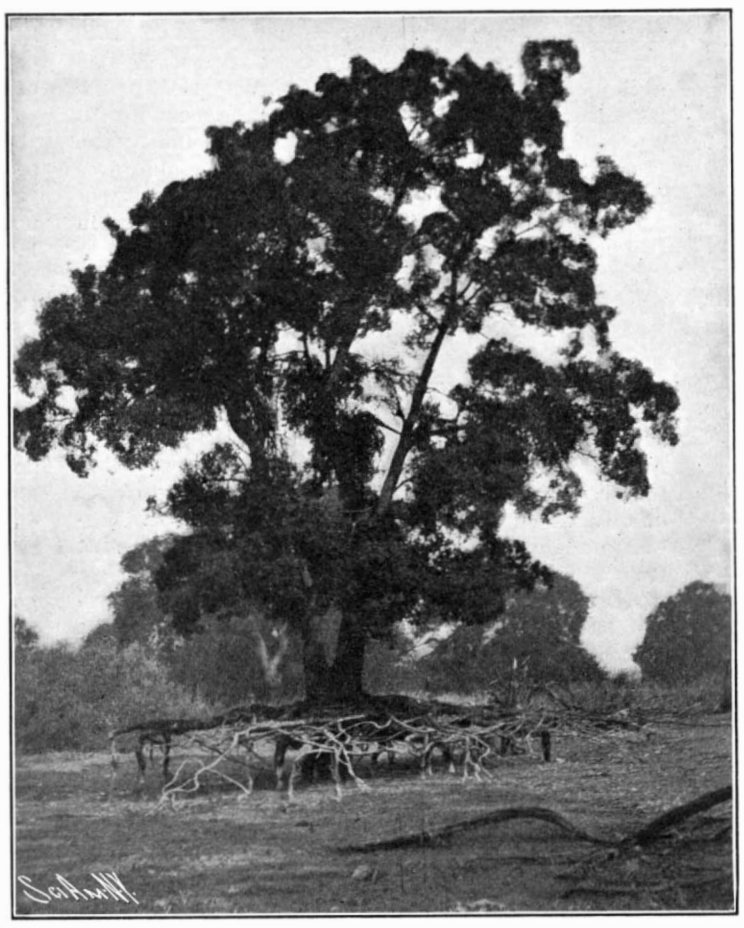
Successful Voyage of the Turbine Steamer "Loongana."

The marine steam turbine has once again demonstrated its possibilities and suitability for the same class of work as that which has hitherto been fulfilled by the ordinary reciprocating engines. Details have recently reached London of the passage of the turbine-propelled steamer "Loongana" from Glasgow to Australia. The "Loongana" is a vessel of 2,440 tons, driven by three Parsons turbines. The journey was covered in 30½ days. The vessel experienced some of the roughest possible weather during the voyage, but even under these most adverse conditions it was found that with four boilers at work, a speed of 18 knots per hour could be easily maintained. Some interesting tests were carried out during the voyage to ascertain the relative economies of the turbine and the ordinary reciprocating engines, and conclusive data were obtained showing at what speeds the turbine is the less expensive. These experiments proved that for vessels where a speed of 16 knots is required, the turbine is much more economical than the cylindrical engines, but it becomes more expensive if the speed is decreased below 15 knots. Special observations were made of the behavior of the turbines and vessel under fluctuating conditions. On no single occasion was there any sign of propeller racing and it was only when traveling at the highest possible speed that any vibration over the screws was experienced, and then it was very slight. Far steadier running was obtained, even in the roughest weather. Not the slightest trouble was experienced with the machinery and the turbines did not have to be stopped for any purpose throughout the voyage except when coaling at ports. Nor did the necessity arise for repairing or renewing any part of the machinery. This is the longest journey that has ever been covered by a turbine-propelled steamer, and the steady running of the vessel under all conditions of weather constituted one of the most prominent features of the journey. Anticipations have been entertained that although this machinery has proved far more economical in regard to fuel consumption than reciprocating engines for vessels engaged in coast and short-distance traffic, it would prove more expensive for ordinary long-distance voyages. The trip, however, has proved the opposite to be the case, and established the superiority of the turbine for long-distance traffic under all conditions.

The British consul at Lyons states that the transmission of electric power over considerable distances is developing, and it is stated that 3,000 horse power is to be transmitted from the Alps, distant 100 miles from Lyons, for the working of the tramway company. The British vice-consul at Grenoble reports that a considerable quantity of electric power is still to be purchased in that district at a cheap rate for the purpose of establishing manufactories of all kinds.

A TREE ON STILTS.

Lake County, to the north of San Francisco, is so named from Clear Lake, which is the largest body of fresh water in the State of California. In this region may be found much fine lake and mountain scenery, for which reason it has been called the "Switzerland of America." Clear Lake is about thirty miles long and ten miles wide in its broadest part. While on a visit there last summer the writer came across the remarkable tree shown in the photograph. It is an oak growing near the edge of the lake, the waters of which have washed away the soil from the roots, and then, receding, have left the tree supported on stilts, as it were. Several other trees on the shore of the lake present a similar appearance, but the one shown was the handsomest and also the most free from surrounding trees or brush.



A TREE ON STILTS.

FIRE PROTECTION FOR SNOWSHEDS ON THE CENTRAL PACIFIC RAILROAD.

BY H. I. BENNETT.

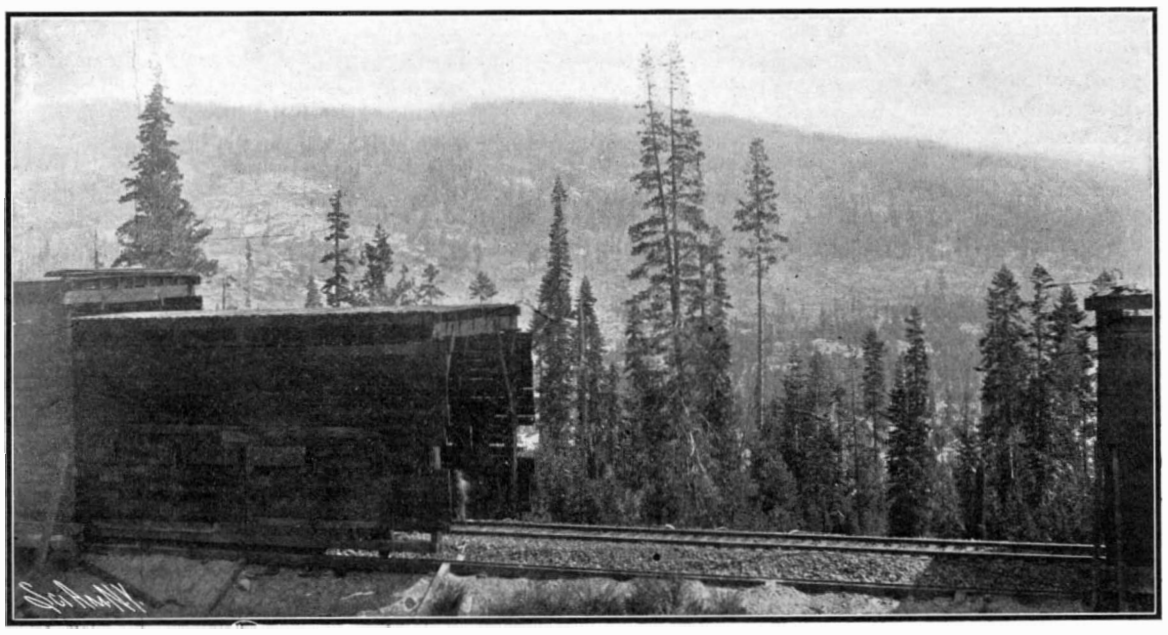
Among the difficulties encountered by the early railroad builders of the West was the heavy and long-continued snowfall of the Sierra Nevada Mountains which, in some winters, aggregates 60 feet in depth. The history of the invention of the snowsheds by the engineers of the Central Pacific Railroad is already well known, and reference has been made at various times to the developments in these unique structures, brought about by peculiar conditions which could not easily have been foreseen. The snowsheds were first built, as naturally suggested itself, with steel roofs and in section somewhat similar to that of an ordinary house, but it was found that the unbalanced weight of the snow on one side or the other, especially on side-hill work, caused continual trouble by throwing them out of line down hill. The next step was to anchor the sheds back to the side-hill with heavy rods attached to the framework of the shed and sulphured or otherwise secured to the rock or earth of the cut. It was found, however, that the snow would melt from beneath the rods, and on the adjacent ground and roof of the shed, so that the entire mass for many feet in depth would hang upon the rods, bending them down and pulling the sheds toward the bank, throwing them out of line in a direction opposite to that which occurred when there were no rods. This brought about a further development, that of extending the roof, where it was practicable, into the adjacent banks, forming a shed which prevented the wedge of snow from piling in between the building and the bank. Many sheds of this form are still in use. This was found to be of such advantage that it suggested the present typical shape, which is that of a flat roof, making the top of the shed somewhat wider than the bottom, so that the melting wedge of snow falls away from the side of the shed instead of pressing against it, and so that the weight upon the base is increased to prevent overturning.

This form of roof of necessity brought the roof covering closer to the stacks of the engines and increased the liability from fire in the dry summer season. To obviate this, deflectors are attached to the smokestacks of the locomotives for the purpose of throwing the sparks to the sides instead of straight up against the roof. These deflectors are so hung that they can be thrown to one side when the engines are not in the sheds.

There still remained the danger from brush and forest fires, from which cause most of the fires now take place, although the right of way is kept clear of brush and trees. On the Central Pacific Railroad, there are thirty miles of continuous snowsheds which, with others in isolated spots, bring the total up to about thirty-three miles. With the advent of the snow plow, it was presumed that the sheds could be ultimately done away with, but near the summit of the Sierra Nevadas the track is subject not only to blockade from snow, but also from avalanches containing rocks, trees, etc., carried along with the sliding snow. Against these the snow plow is of no avail, and during the long-continued heavy storms only snow plows could use the tracks, to the exclusion of traffic, as otherwise the deep cuts would fill behind the plows almost immediately. It seems, therefore, to be impracticable to dispense with the snowsheds in this section of the country, in which the snow lies upon the ground in some years from November till June.

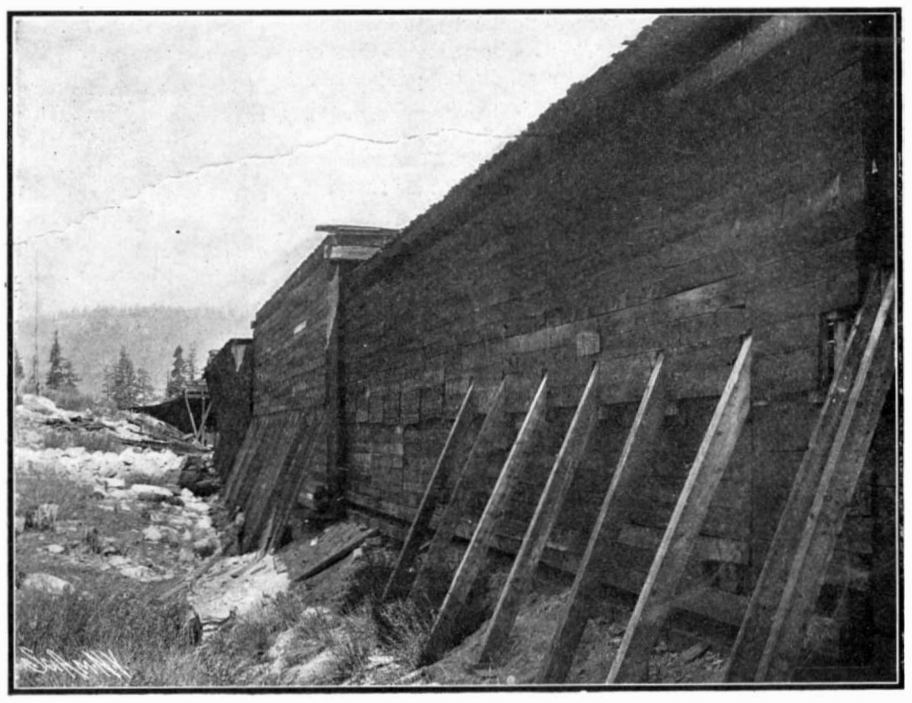
The stretch of road subject to such conditions is comprised within a distance of thirty-three miles, lying about equally on each side of what is known as the "Summit," or station at the summit of the Sierra Nevada Mountains on the Central Pacific Railroad. Considering this long distance of continuous shed, a danger of great loss and delay due to fires constitutes a continual menace to operation. To take care of this, a very elaborate system of watchmen, connected with each other and with various intermediate points by telephone, and an alarm signal system have been devised. There are seven of such watching or lookout stations at which watchmen are stationed day and night. From one of these—Red Mountain—several miles from the track and two thousand feet above it, nearly the entire line of sheds is visible. There are maintained at all times three fire trains—one at Blue Canon, one at the Summit, and one at Truckee—and a fourth during the driest part of the summer at Cisco, making one fire train at each end of and two near the middle of the sheds. These trains are always ready, with steam up and crews at hand. Each consists of a locomotive, fire-fighting brigade, and water cars, which, with the prompt notice received, can get to any point within a very few minutes and extinguish a

(*Continued on page* 466.)



Telescopic Shed, Partially Opened.

Looking Through Telescopic Snowsheds.



Telescopic Snowshed Entirely Closed.

FIRE PROTECTION FOR SNOWSHEDS ON THE CENTRAL PACIFIC RAILROAD.

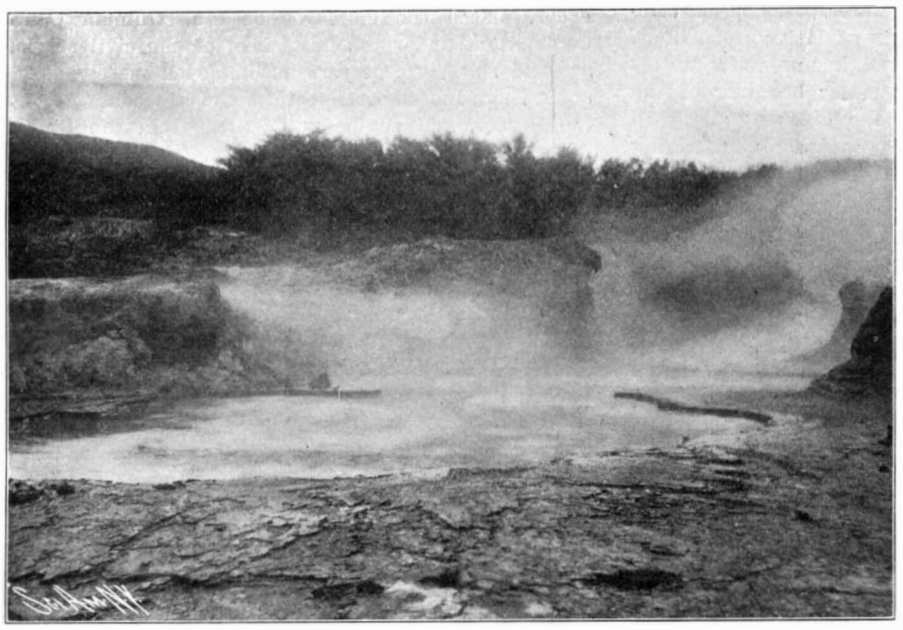
THE LARGEST GEYSER IN THE WORLD.

BY OLIVER JOHNSON.

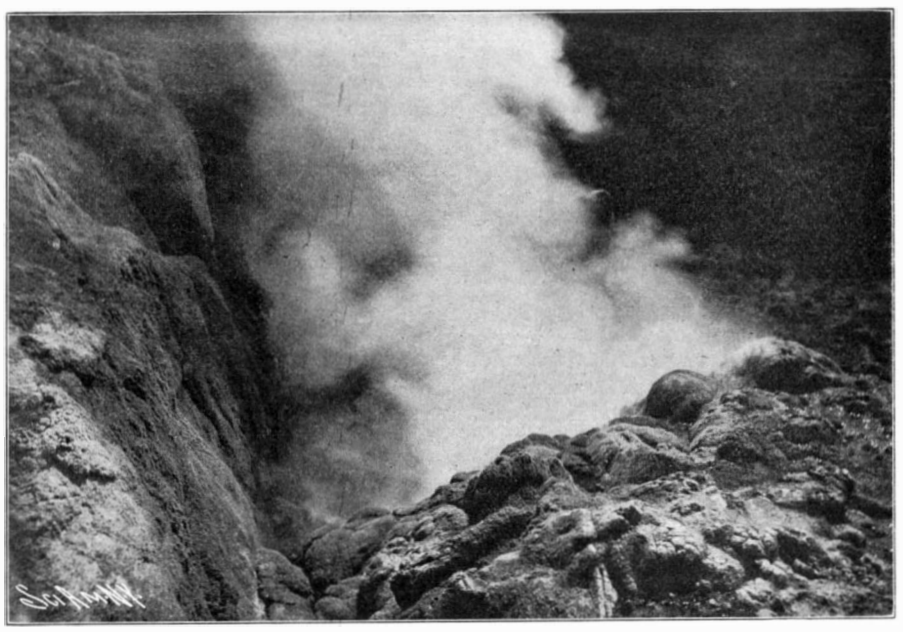
One of the marvels of the earth is the gigantic geyser located at Rotorua, New Zealand, and known as "Waimangu."

Waimangu made its appearance about a couple of years ago. It is situated along the line of that great volcanic rent or fissure covered by the fearful eruption of Mount Tarawera in 1886, and is a short distance from the site of the one-time famous pink and white terraces of Rotomahana, whose beauties were completely swept out of existence by that awful upheaval.

The crater out of which Waimangu issues is fully half an acre in extent, and of enormous depth. When in eruption the whole of this gigantic funnel is filled

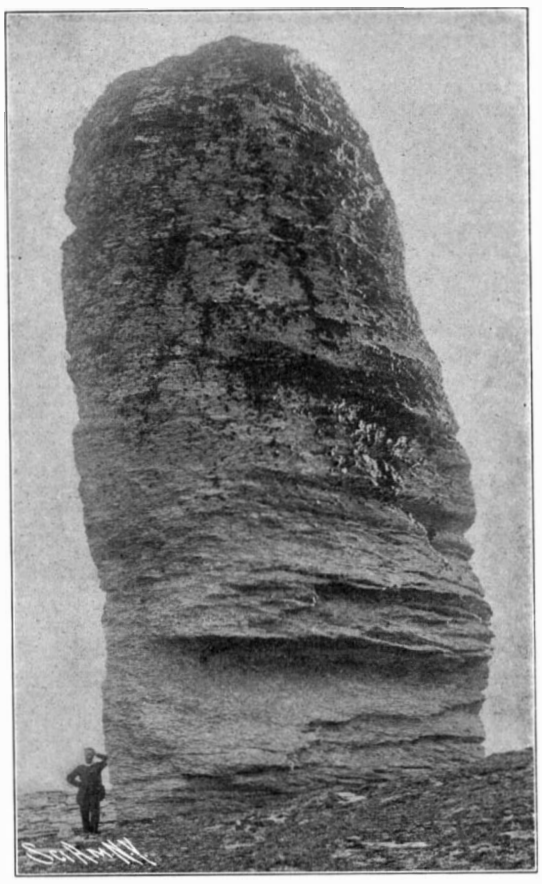


"Hell's Gate," a Pool of Boiling Mud.

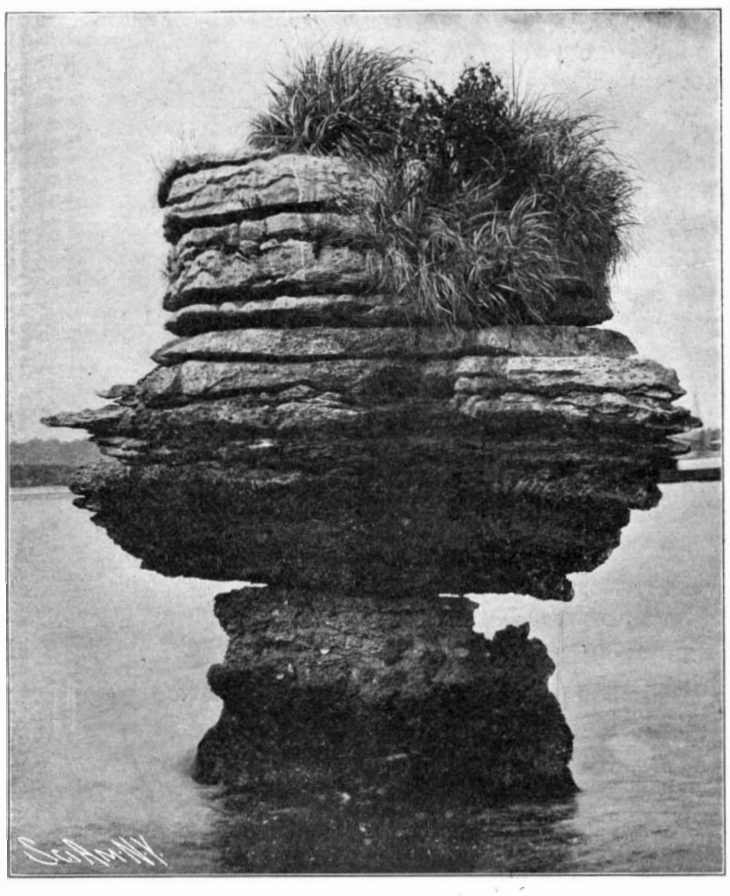


The Wavieki Geyser.

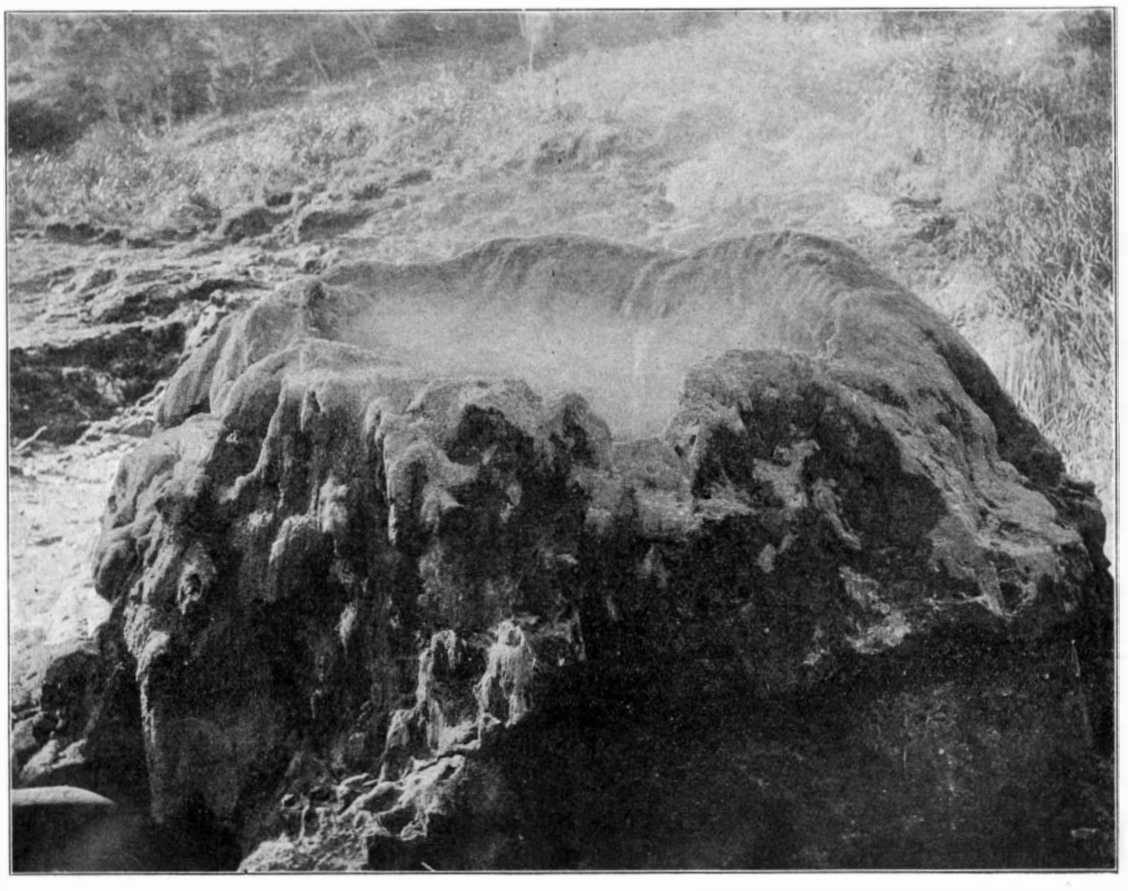
The Great "Waimangu" Geyser.



The "Old Man." Height 70 Feet.



The "Wine Glass"—a Great Limestone Formation.



A Characteristic Geyser in New Zealand's Wonderland.

THE NATURAL WONDERS OF NEW ZEALAND.

with a huge column of black, boiling mud and stones that shoots in the air to a height of nearly a thousand feet, while the cloud of steam which accompanies it rises in calm weather several thousand feet. The displays of this colossal geyser occur with great suddenness, and frequently the venturesome visitor has to flee to a place of safety. To see it in eruption is the sight of a lifetime. The awful force manifested by the ejection of the vast body of water and stones, the terrific roar of steam and hurling rocks add to the weird grandeur of the phenomenon. No one can look on Waimangu without being awed by its force and sublimity.

Waimangu is really located in the center of the marvelous hot lakes and thermal springs region, Rotorua district, the tourist or sightseer being conveyed thither in a few hours by train from Auckland, the former capital of New Zealand and the principal port of the colony.

So much has been said and written about the hot lakes and thermal wonders, that it would be almost waste of time and ink to describe them lengthily. Pools and springs of every degree of heat are to be found. Some are boiling caldrons, others are spluttering pits of mud and sulphur, sending up clouds of steam and sulphurous fumes, while others again are of the clearest green or deepest, pure blue, beautiful beyond comparison. The curative powers of these hot springs are becoming widely recognized, for they act like a charm on skin diseases, rheumatism, gout, dyspepsia. Thousands of invalids come from far and near, and thousands of tourists come to this district, which teems with natural wonders. The enchantment of this curious region is also added to by the fact that it is the home of the Maori, and is fraught with the legends and traditions of that noble race.

New Zealand may be said to be honeycombed with natural phenomena, and not least among which are the peculiar-shaped limestone formations of the north of Auckland and southern Otogo districts, which in many instances are caused by the action of ocean waves, as illustrated by the photograph of the "wineglass." In the Otogo district, however, there are veritable land "crops" of such formations, of various heights, the one depicted in the photograph being seventy feet, and known as the "Old Man."

FIRE PROTECTION FOR SNOWSHEDS ON THE CENTRAL PACIFIC RAILROAD.

(*Continued from page* 464.)

fire without much difficulty; for instance, during a recent summer, the total loss through fire was extremely small—not over $100 total at the outside; but occasionally, in spite of all precautions, the fire will get under way and destroy some miles of shed before it can be stopped. It has been found that, in such cases, the only effectual way to stop a fire is to tear down a gap of from 50 to 100 feet in length, which prevents the remainder of the shed acting as a chimney and drawing the flame along, as it does when uninterrupted, with great velocity, the heat being so intense that it destroys not only the rails but the ties buried in the ballast.

The recurrence of these fires, with the heavy loss entailed by them through loss of property and delay to traffic, suggested the idea to the maintenance-of-way officers of the Southern Pacific Railroad Company of supplying gaps at suitable intervals along the line which can be closed before the winter storms set in. This consideration brought out the design which the accompanying drawing and photographs illustrate. The gaps or telescopic sheds consist of sections 50 feet long and sometimes two sections 50 feet long of movable shed running on wheels on a track having a gage of 16 feet 8 inches, the rails being supported on sills outside the ballast line of the main track. These telescoping pieces are arranged to run inside a section at one or both ends of the gap, built larger for that purpose. During the winter, the sections are closed and extra braces of sufficiently stout construction are bolted on, and the shed is then continuous and of practically the usual construction. As soon as the heavy storms are over and the snow has practically ceased falling for the winter, the dotted braces are removed and the telescopic shed slid into the adjacent large section, using for the purpose a switch engine, a few men with block and tackle, or a work train.

These movable or telescopic sheds are intended to be placed at distances of from 2,000 feet to a half mile apart in places favorable to their location. They are not necessarily built upon tangents. In fact several of them are upon curves, but the curvature of the track must be unchanged over the gap and within the enlarged section adjacent thereto.

The Southern Pacific Company now has in position some sixteen of these telescopic snowshed sections, and so far they have proved successful in stopping the progress of any fire which has gotten beyond control and will undoubtedly prevent the destruction from this cause of more than one section at a time at the worst. Credit for these snowsheds should be given to Mr. Isaacs, of the engineering staff of the railroad.

Engineering Notes.

Spain produced 175,109 tons of lead in 1903, exceeding the output of all other countries except the United States. Mexico is the third largest producer, and Australia comes fourth in order.

It has been found that a rod of tin-aluminium alloy, when filed and plunged in cold water, gives off gas composed of hydrogen and oxygen in explosive proportions. An unfiled rod, on the other hand, has no action unless the water is boiling. This peculiar behavior of the metals may be explained by the different states in which they exist, says the Engineering and Mining Journal. It is believed that the aluminium and tin form a true alloy only at the surface of the rod, so that by filing an almost infinite number of junctions of the two metals are laid bare, which act as thermo-couples.

The construction of the Berber-Suakin railroad in the Sudan is being pushed forward with all speed. The Sudan government is contemplating the establishment of the Red Sea terminus at Sheik Barghut, a port some distance north of the originally intended terminus of Suakin. This decision is influenced by the superior accommodation available at the former point for larger ships than can be handled at the port of Suakin, while navigation can also be carried out during the day or night. The track is being laid from the Red Sea end. This section presents many engineering difficulties, as between Suakin and Sinkat the line rises to 3,600 feet above sea-level. Automobiles are also being introduced at Khartum, specially designed for passenger traffic in the desert. Great difficulty has been experienced in finding motor cars capable of traveling over the sand. Recent experiments, however, it is anticipated, will have resulted in the employment of an automobile suitable for service under these adverse conditions.

An interesting and powerful type of ice-breaking steamer has been launched on the River Clyde, to the order of the Canadian government, for work on the St. Lawrence River. The vessel measures 245 feet in length by 40 feet 6 inches beam and 18 feet depth, with a gross tonnage of about 1,350 tons. The vessel is of abnormal strength in order to resist the enormous ice pressure to which it will be subjected. At the bows, where the maximum pressure will be exerted, the shell plating is of double thickness, with intermediate frames extending all fore and aft. The keel, stem, stern post, propeller brackets, and rudder are also extra strong and heavy and made of nickel steel. On the stern post is fitted a massive cast-steel knife for the dual purpose of cutting a passage through the ice when driven astern and protecting the rudder stock. Water ballast is provided for in a cellular double bottom and so arranged that the boat can be trimmed in any manner to assist in the forcing of a passage while at work. The craft is propelled with twin screws. Although primarily designed for ice-breaking work, the vessel is at the same time built with fine lines in order to render a high speed to be obtained for other purposes, such as a government yacht.

A special commemorative grand prize was awarded to the Pennsylvania Railroad system for its original series of scientific investigations of locomotive performance conducted at the Louisiana Purchase Exposition. The Committee of Five, composing the Superior Jury, was unanimous in this action. In the Department of Liberal Arts a grand prize was awarded for the model of the terminal passenger station in New York city. In the Department of Transportation Exhibits there were each awarded a grand prize the locomotive testing plant and laboratory, the railway postal and mail car, the model of the West Philadelphia terminal, the model of the New York and Long Island Railroad tunnels, full-sized section of tunnel under the North River, exhibit of maps and drawings illustrating improvements made on the Pennsylvania Railroad. A commemorative gold medal was awarded in connection with the exhibit of the De Glehn four-cylinder balanced compound locomotive. In the Department of Social Economy were awarded a gold medal for the exhibit of the pension, relief and saving fund departments of the Pennsylvania Railroad and the Pennsylvania lines west of Pittsburg; a gold medal for the exhibit of the Pennsylvania Railroad Department Young Men's Christian Association of Philadelphia. The most important of these awards is the first. This award is unique and special, and as such may be regarded as the highest official award made by the exposition. It is not for an exhibit, but is a special recognition of the progressiveness of the Pennsylvania Railroad system in making, at its own great cost, investigations of the highest scientific value, the methods and results of which are a permanent contribution to the advancement of engineering knowledge. The Pennsylvania Railroad system chose an advisory committee of international character to aid in conducting the investigations and selected for test locomotives of foreign as well as of home manufacture, in order that the investigations should be made upon broad lines and under the best conditions to produce useful and authoritative results.

Employment Under the Isthmian Canal Commission.

On November 15, 1904, the President, by executive order, placed the employés of the Isthmian Canal Commission under the provisions of the civil service act and rules, except persons employed merely as laborers, persons whose appointments are confirmed by the Senate, and engineers detailed from the United States army. This order, however, excepts from the requirement of competitive examination a number of positions specifically enumerated. With these exceptions all positions of whatever character or designation under the Canal Commission, whether in the United States or upon the Isthmus of Panama, are subject to the requirement of competitive examination. Vacancies in clerical and other positions in the office of the Canal Commission in Washington will be filled as far as practicable from suitable existing registers of eligibles, but for positions on the Isthmus of Panama examinations will be held at various cities throughout the United States and also upon the Isthmus, as the needs of the service may require. Qualified eligibles on existing registers may, however, be certified to such positions in the absence of registers prepared as a result of special examinations for the Canal Commission. At the present time the number of employes needed in many branches of the work cannot be definitely stated, but as rapidly as the needs of this service are known, examinations will be announced indicating the particular requirements of the positions to be filled, the salary to be paid, and other necessary information.

The age limits for entering the service are eighteen to forty years, unless otherwise expressly stated in announcements of examinations. These limits, however, do not apply to applicants entitled to claim of preference under Section 1754, Revised Statutes.

For the further information of applicants and others, the following statement is published relative to conditions of employment on the Isthmus of Panama under civil service rules by the Isthmian Canal Commission.

The construction of the Panama Canal may extend throughout a time period of eight or more years, according to the details of the project yet to be adopted. (This time estimate is from the report of the last Isthmian Canal Commission.)

The civil service of the Isthmian Canal Commission offers excellent opportunities to qualified persons, both in the matter of salaries and promotion. Under the operation of the civil service law it is contemplated that promotions will be made upon the basis of merit from the lower to the higher positions.

Medical attendance, medicines, and care at hospitals when sick, are furnished to the employes of the Isthmian Canal Commission without cost. Well-equipped hospitals will be maintained at Ancon, adjacent to Panama, and at Colon. In meritorious cases sick leave on pay may be allowed, in addition to the regular leave of absence, not to exceed thirty days for employes who are from the United States, or fifteen days for employes who are residents of the Isthmus.

The Isthmian Canal Commission furnishes quarters to its American employes, or at its option in lieu thereof commutation, which has tentatively been fixed at eight per cent of the salary. The Commission proposes to maintain a civil commissary department on the Isthmus, which is soon to be established and the advantages of which are to be made available to the salaried employes of the Commission.

The Isthmian Canal Commission furnishes its employes free transportation to the Isthmus from either New York, New Orleans, or San Francisco, and, also, free return transportation upon completion of satisfactory service.

The employes of the Isthmian Canal Commission are allowed six weeks' leave of absence annually on full pay. This leave of absence is not granted until after eight months of satisfactory service. In visiting the United States on leave, employes and members of their immediate families are granted special rates to the above-named ports. (The prevailing special rates are $25 between New York or New Orleans and Colon, and $70 between San Francisco and Panama.) The special rates also apply when members of the family of an employe accompany him to the Isthmus.

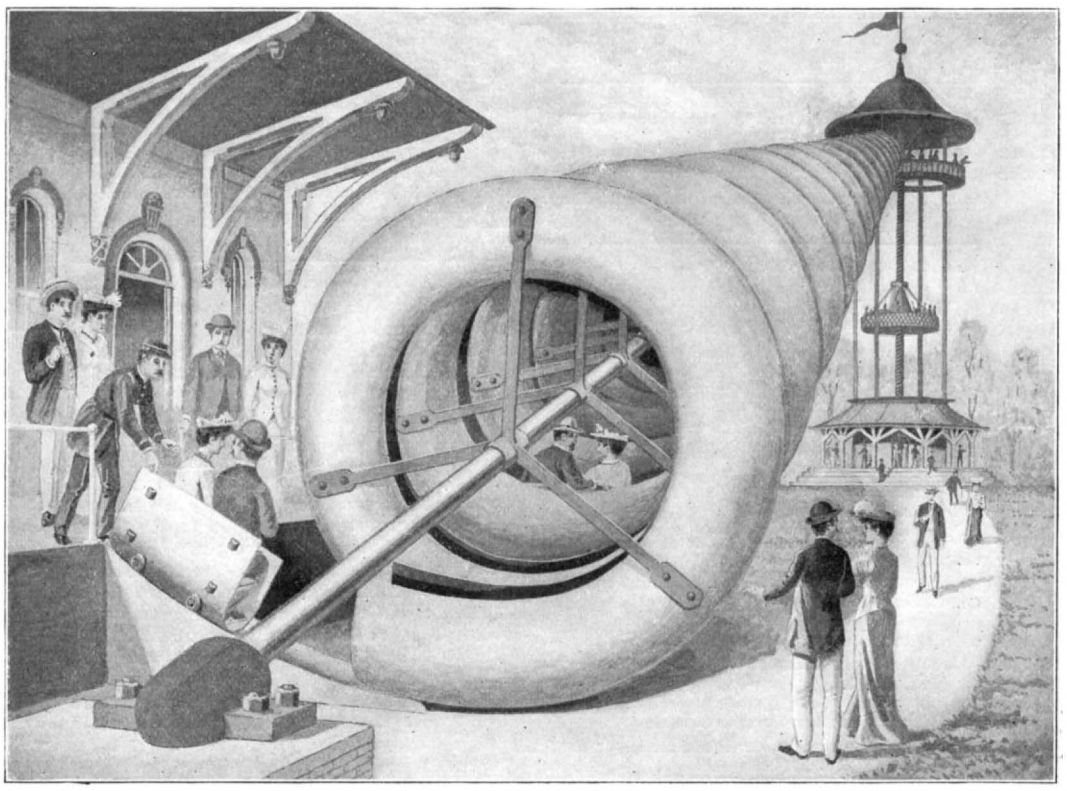
All salaries or wages paid by the Isthmian Canal Commission to employes from the United States are in gold or its equivalent in United States currency.

All inquiries concerning examinations for competitive positions under the Isthmian Canal Commission should be addressed to the United States Civil Service Commission, Washington, D. C.

Further communication relative to service, situation, climate, and conditions on the Isthmus should be addressed to the Isthmian Canal Commission, Washington, D. C., by whom the foregoing details have been furnished.

A NOVEL ADAPTATION OF THE ARCHIMEDEAN SCREW.

An ingenious inventor has revived the old principle of the Archimedean screw, and adapted it for use as an amusement apparatus for pleasure resorts, fairs, and the like. It will be recalled that the screw which Archimedes is accredited with having invented was a spiral conduit that rotated on an inclined axis. It was used for raising water, the lower end of the screw being immersed in a body of water, and on being rotated the water would constantly flow toward the bottom of each convolution of the spiral conduit, and be thereby raised to the upper end of the screw. In the present adaptation of the Archimedean screw, a spiral trough is used, which is supported by a central shaft turning in suitable bearings, also by a series of rollers bearing against the under side of the trough. Traveling on tracks in the trough are cars, each carrying two or three persons, which are lifted up by the rotation of the spiral trough. As in the case of raising water, the car constantly gravitates to the bottom of the particular convolution in which it is situated, but as the bottom is constantly advancing forward and upward, the car is likewise progressively moved forward and upward, until it reaches the top of the spiral trough. The tower at the upper end of the screw furnishes a suitable upper bearing for the shaft of the spiral trough, and also provides a suitable landing for the passengers. The cars when emptied of passengers are carried by gravity down an inclined plane to the starting point. This inclined plane is not shown in the accompanying engraving, being hidden by the spiral trough. The landing at the top of the tower comprises an annular platform, which surrounds the passenger drop. The latter consists of a circular car formed with a nut which is threaded on to a simple, vertically-disposed screw. In operation the car will move downward by gravity, and at the same time will turn with the nut around the screw. The nut is formed of two sections which, under control of the operator, may be moved together to tightly grip the screw, and thus act as a brake to prevent too rapid a descent of the car. The car is raised by counter-weights when relieved of the weight of the passengers, and when the operator relaxes the strain of the nut on the screw. The apparatus should afford considerable entertainment. The passengers first experience the unusual sensation of having a spiral trough whirled rapidly about them, while they advance slowly and in a straight line up to the top of the tower, and then in descending they experience another unusual sensation just the reverse of the first, as they wind rapidly downward around the stationary screw. The inventor of this apparatus is Mr. John J. Carr, of 282 Van Brunt Street, Brooklyn, N. Y.



A NOVEL ADAPTATION OF THE ARCHIMEDEAN SCREW.

A RIVER OF FISH.

Lake County, one of the most picturesque of the northern counties of California, is so named from Clear Lake, the largest body of fresh water in the State. From its varied scenery of mountain and lake, it has been called the "Switzerland of America."

Several creeks run into Clear Lake, one of the principal being Kelsey Creek. Each spring the fish run from Clear Lake up Kelsey Creek, to spawn, sometimes in so great numbers that wagons, in crossing, crush many of them. It happens in some seasons that the dry weather, coming on suddenly, causes the waters of the creek to subside rapidly. Then the fish are left stranded and die in countless millions. The farmers cart off wagon-loads of them to use on their fields as fertilizer, and the stench arising from their decaying bodies makes the neighborhood almost uninhabitable. The photograph was made by a local druggist and shows Kelsey Creek at a point one mile from the town of Kelseyville and seven miles from Lakeport, the county seat.

A RIVER OF FISH—KELSEY CREEK, CALIFORNIA.

A Lost Invention.

"Fame and fortune await the lucky individual who can rediscover the combination of metals from which the Egyptians, the Aztecs, and the Incas of Peru made their tools and arms. Though each of these nations reached a high state of civilization, none of them ever discovered iron, in spite of the fact that the soil of all three countries was largely impregnated with it. Their substitute for it was a combination of metals which had the temper of steel. Despite the greatest efforts, the secret of this composition has baffled scientists and has become a lost art. The great explorer Humboldt tried to discover it from an analysis of a chisel found in an ancient Inca silver mine, but all that he could find out was that it appeared to be a combination of a small portion of tin with copper. This combination will not give the hardness of steel, so it is evident that tin and copper could not have been its only component parts. Whatever might have been the nature of the metallic combination, these ancient races were able so to prepare pure copper that it equaled in temper the finest steel produced at the present day by the most scientifically approved process. With their bronze and copper instruments they were able to quarry and shape the hardest known stones, such as granite and porphyry, and even cut emeralds and like substances. A rediscovery of this lost art would revolutionize many trades in which steel at present holds the monopoly. If copper could thus be tempered now its advantage over steel would be very great and it would no doubt be preferred to the latter in numerous industries. It is a curious fact that though this lost secret still baffles modern scientists it must have been discovered independently by the three races which made use of it so long ago."

The above item from a Sunday paper is an example of many such floating about which both reflect and impress an exaggerated sense of the importance of a so-called lost invention or art. The writer says: "A rediscovery of this lost art would revolutionize many trades in which steel at present holds the monopoly." Why would there be any revolution? Is any man sighing for a copper razor, or does any boy want a brass jack-knife blade? There is no evidence to prove that the tempered copper tools of the ancients were capable of holding a keen edge like steel; on the contrary, they were probably very crude and unsatisfactory substitutes for what we now have. The United States Government Board, appointed twenty-five years ago to test iron, steel, and other metals, reported through their chairman, Prof. R. H. Thurston, in that portion relating to copper-tin alloys, that alloys of copper 72.89, tin 26.85, tin 29.88, copper 68.58, tin 31.26; copper 67.87, tin 32.10; and copper 65.34, tin 34.47 were all so hard that they could not be turned in a lathe with steel tools. These and other hard combinations have been generally known to the trade for years, but of what good are they? Copper and its alloys are more costly than the ordinary grades of tool steel, and the only apparent advantage possessed is that they are incorrodible. It is difficult to understand that this would be the cause for any revolutionary change, and we are forced to the conclusion that such statements are what, in current slang, is known as "hot air."—Machinery.

According to the Iron Age a compound gas engine has been built with two high-pressure cylinders and a single low-pressure cylinder between them. The high-pressure cylinders work on the Otto cycle, the engine receiving one impulse from them each revolution. The exhaust from the two explosions is expanded in the low-pressure cylinder, the crank of which is 180 degrees behind the high-pressure cranks. Thus at every forward stroke the low-pressure cylinder takes the exhaust gases from one of the high-pressure cylinders. The total effect is thus to produce an impulse every half revolution. With a 12 horse-power engine 13 brake-horse-power were obtained with the low-pressure cylinder in use, and only 8.9 horse-power without it, 46.2 per cent being thus added to the power by the use of the low-pressure cylinder and without the expenditure of any additional fuel.

Pennsylvania, which makes more than half the iron used in the United States, produces less than 2 per cent of the iron ore mined. Ohio, which comes next to Pennsylvania as an iron-maker, mines less than 0.1 per cent of the total. In both cases the ore is brought to the fuel; and this is the policy in this country. Only in Alabama are the ore and fuel found together.

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

COMBINATIONAL TELEGRAPH INSTRUMENT.—F. González-Barbosa, Panama, Panama. The invention relates to communication by wire, and more particularly to the production of a combinational instrument which may be used at will as a key, a sounder, a repeater, or a commutator. The invention also has reference to a system of wiring whereby this instrument may be connected for use in various relations. The apparatus is suitable for both open and closed circuits.

Of Interest to Farmers.

COTTON CHOPPER AND CULTIVATOR.—J. A. Bartlett, W. S. Downs and J. B. Tillman, Dardanelle, Ark. In this patent the invention relates to agricultural implements, and especially to the class of cultivators. The object of the inventors is the provision of an implement of simple construction intended for the purpose of chopping or thinning cotton in the field, the invention adapting itself readily to be applied to an ordinary cultivator as an attachment.

ANIMAL-FEEDER.—P. E. Howard, Hitchcock, Oklahoma, and C. F. Howard, Deepwater, Mo. The invention refers to improvements in devices for supplying feed to animals, particularly hogs, an object being to provide a feeder adapted to supply shelled corn, bran, meal, or other food to a trough from which animals feed and so arranged that the flow of meal to the trough may be adjusted for the food it contains.

ANIMAL-STALL.—W. M. Underhill, Oconto, Wis. One purpose of this inventor is to economize in the cost of construction of stalls and to provide each stall with an adjustable front bar placed far enough back to touch in front of the withers when the cow is eating from the floor or a low manger and to touch the lower part of the throat when the head is above the bar, such cross-bar being also placed so far back as to render it necessary for the cow to swing her head to the right or left crosswise of the stall when changing from one position to the other.

Of General Interest.

DIE.—G. Kepper, New York, N. Y. In this instance the invention of Mr. Kepper has reference to an improved apparatus for stamping articles from flat metal stock. It is especially intended for stamping in high relief images and the like on metal plates or disks for jewelry or for various other purposes.

CONSTRUCTION OF FALSE BEAMS, INTERIOR CORNICES, OR THE LIKE.—W. Nielson, New York, N. Y. The object here is to provide certain improvements in the construction of false beams for ceilings, interior cornices, and like structures employed for embellishing the appearance of a room, the arrangement being such that the structure is fireproof, can be given any ornamental shape, can be readily placed and secured in position on the ceiling or wall, and cheaply manufactured.

PORTABLE DARK ROOM.—E. L. Hall, New York, N. Y. The purpose in this invention is to provide a collapsible dark room, one which can be compactly and flatly folded and conveniently carried in a dress-suit case, for example, and quickly and readily set up and braced in said set-up position. Further to provide sleeves at the ends of the device constructed of pliable material and arranged to fold into the body of the device when it is collapsed and so that when the arms of the operator are introduced the hands are free, yet a light-tight connection obtained between the arms of the operator and the sleeves.

Hardware.

DOOR-BRACE.—F. Dahlund, Esmond, N. D. The object here is to provide a brace for trapdoors, such as used in cellars and other places, arranged to permit of conveniently swinging the door upward into an open position and to automatically hold it therein. It is easily adjusted to suit different sizes of doors, as well as the weight thereof.

WRENCH.—W. V. Gage, Omaha, Neb. Mr. Gage's invention relates to wrenches and spanners and is especially adapted to the form known as "S-wrenches," as well as to straight wrenches. The objects are to provide a wrench which will be adapted to operate upon nuts and bolt-heads of different sizes and thicknesses without the use of complicated adjusting devices and with a corresponding simplicity and cheapness of construction.

Machines and Mechanical Devices.

MACHINE FOR LAYING CABLES ON WINDING-DRUMS.—A. F. Wheaton, Menlo, Wash. This invention relates to improvements in mechanism for laying cables on the winding-drums of logging-engines, hoisting-engines, and the like, the object being to provide an automatically-controlled device by means of which the cable will be placed on the drum in even layers while moving in either direction along the drum, thus preventing injury to the cable by overlapping.

Pertaining to Vehicles.

FELLY-JOINT.—J. B. Higginbotham, Norman, Cleveland County, O. T. In this instance the invention relates to an improved device for connecting the sections of a wheel-felly so that the necessary tension may be exerted on said sections to draw them forcibly together and produce a rigid, self-sustaining felly, which with the addition of the tire encircling it forms a most secure and durable structure.

Note.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of the paper.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

MUNN & CO.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 6318.—For manufacturers of mud guards or fenders made of paper or similar substance, for use on automobiles.

Autos.—Duryea Power Co., Reading, Pa.

Inquiry No. 6319.—For manufacturers of wall paper printing machinery.

For hoisting engines. J. S. Mundy, Newark, N. J.

Inquiry No. 6320.—For manufacturers of or dealers in shot tower machinery.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 6321.—For makers of punch machines, benders and presses, complete, for making "H. S."; also for the present address of the Chahal Boiler Co.

Perforated Metals, Harrington & King Perforating Co., Chicago.

Inquiry No. 6322.—For makers of glass paper weights and other novelties of a like kind.

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 6323.—For makers of aluminium pin trays, also other aluminium novelties.

Adding, multiplying and dividing machine, all in one. Felt & Tarrant Mfg. Co., Chicago.

Inquiry No. 6324.—Wanted, the address of the following concerns: Eclipse Gun Co., Laclede Arms Co., Royal Gun Works, Burgess Gun Mfg. Co.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 6325.—For manufacturers of potters' wheels and general machinery for manufacturing porcelain.

Robert W. Hunt & Co. bureau of consultation, chemical and physical tests and inspection. The Rookery, Chicago.

Inquiry No. 6326.—For manufacturers and exporters of bungs for kegs, barrels, etc., also for shoe pegs.

We manufacture tripoli stones of all dimensions, disc, cylinders, etc., samples free. Seneca Filter Co., Seneca, Mo.

Inquiry No. 6327.—For machinery for boring and filling brushes in general for scrubbing, store and household use.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Machine Company. Foot of East 138th Street, New York.

Inquiry No. 6328.—For parties engaged in manufacturing Indian clubs, balls, etc., from cork.

Any metal, sheet, band, rod, bar, wire; cut, bent crimped punched, stamped, shaped, embossed, lettered. Dies made. Metal Stamping Co., Niagara Falls, N.Y.

Inquiry No. 6329.—For the present address of the Brown Cochran Carbonic Gas Machine Co.

I have every facility for manufacturing and marketing hardware and housefurnishing specialties. Wm. McDonald, 190 Main St., East Rochester, N. Y.

Inquiry No. 6330.—For an automatic telegraph transmitter.

We manufacture gasoline motor and high-grade machinery, castings best quality gray iron. Select patterns, and let us quote prices. Frontier Iron Works, Buffalo, N. Y.

Inquiry No. 6331.—For makers of gasoline machines.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machinery and tools. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 6332.—For makers of electric thermostat.

The Scientific American Supplement is publishing a practical series of illustrated articles on experimental electro-chemistry by N. Monroe Hopkins.

Inquiry No. 6333.—For the manufacturer of the Ideal Shine Cabinet for blacking shoes.

Drawings, Estimates, Tools, Dies, Sheet, Wire and Rod Specialties (all metals). Stamping, Spinning, Turning and Screw Work. Tin Plating, Nickel Plating, Bronzing, etc. The W. S. Burn Mfg. Co., New Haven, Conn.

Inquiry No. 6334.—For makers of the handy potato and fruit slicer, having a plain bottom with fluted corrugated knife, with sliding holder for holding the vegetable.

Inquiry No. 6335.—For information as to supply of infusorial earth, calcined and free from grit or impurities.

Inquiry No. 6336.—For makers of pocket cigar lighter.

Inquiry No. 6337.—For an air pump to be used by hand for exhausting a glass tube.

Inquiry No. 6338.—For makers of railroad tricycles or hand cars.

Inquiry No. 6339.—For machinery for making baskets, boxes, crates, etc.

Inquiry No. 6340.—For makers of square copper tubing.

Inquiry No. 6341.—For makers of hardware specialties for household use.

Inquiry No. 6342.—For makers of mechanical and scientific toys.

Inquiry No. 6343.—For makers of stationery specialties.

Inquiry No. 6344.—For makers of reversed gas burner and novelties in gas and oil lighting and heating apparatus.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(9509) R. W. M. says: Has not electricity been used long enough as energizing force for running machinery and power plants, so that machinery and power plants thus worked, operated, energized, and installed should be expressed by a different word than "electrify" and its derivations? The common meaning of "electrify" is "to thrill," technical meaning "to charge with electricity." Now what is wanted is a word meaning "to work, operate, energize with or by electricity," and it is not hard to find it in the Greek compound "electron" and "ergon," the latter being well anglicized in the word "en-ergy" and its derivations. Am I not right, thinking that a machine would run longer, stronger, and steadier *electrigized* than it would if only *electrified,* that is, simply charged with electricity? A. It is all right to make a new word as a name for a new thing or fact. People will use it or not, however, as they choose. "Electrigize" does not suggest its derivation from "ergon" and "elektron," the two Greek words, since the essential letter "r" of ergon does not appear in it. We hardly think people will take to the proper form of the derivative, which should be "electrirgize." It has an awkward sound.

(9510) C. S. asks: 1. I have a small induction coil. Length between end pieces 3 inches; core, ⅜ inch thick. Primary, three layers No. 18. Secondary, 5 ounces No. 30. Condenser, twenty sheets tinfoil 3 x 3 inches. This coil gives powerful shocks, but will not spark at the secondary. The vibrator does not buzz good. Is the core too small? I use one dry cell. Is it possible to work it with a telephone generator, thus doing away with the vibrator? A. Your little coil may give a spark ¼ inch long if you put on more battery. Two or three cells of dry battery will be required for it, since dry cells are very weak affairs. The vibrator will work more forcibly if more current is given to it. The core is not magnetized strongly enough to make the vibrator move far and fast enough to break the circuit quickly. 2. How can you tell the proper amount of zinc sulphate and blue vitriol in a Crowfoot cell without a hydrometer? A. The copper sulphate solution in a Crowfoot battery must be saturated, and there must be crystals of the sulphate still remaining undissolved in the bottom of the jar on the copper plates. No zinc sulphate need be put into the cell at first. Put only water round the zinc at the top of the jar, and short-circuit the cell. Zinc sulphate will soon be formed, and the cell be ready for action in perhaps twelve hours. 3. Why is it that two Crowfoot cells will not ring a bell? A. Two Crowfoot cells will ring a bell whose resistance is low. If the resistance is high, more cells will be required to send current enough through the bell to ring it. 4. Is the powdered carbon that is packed around the carbon stick in a dry cell fit to use over again? A. The powder in a dry cell should not be used again. It is a mixture of carbon and manganese dioxide, and is rendered useless by the running of the cell. If it were only carbon, it might be used for any length of time.

(9511) T. J. W. says: 1. What is the reduction in volume of compressed air to 100 pounds? A. Compressed air at 100 pounds pressure fills 0.128 of its free volume. 2. What reduction in volume at 50 pounds? A. At 50 pounds pressure 0.227 of its free volume—isothermally. 3. (a) How many cylinders of a given size (say 3 x 6) would be required to compress air sufficient to run an ordinary reciprocating slide-valve engine of the same size, all running at same speed, engine carrying load at 200 revolutions per minute, compressors to maintain pressure of 100 pounds? (b) How many compressor cylinders could be cut out by reducing pressure to 50 pounds? A. The loss by the transmission of compressed air depends upon its use while hot from the compressor or after having cooled to atmospheric temperature. If used at the temperature of compression, the loss may be 50 per cent, or require twice as many compression cylinders as motor cylinders. If used cold, three times as many will be required to keep up the air supply. The same relation of cylinders will be required at any pressure.

NEW BOOKS, ETC.

Wire and Wireless Telegraphy. By Edwin B. Moore. Springfield, Vt.: Springfield Reporter Publishing Company, 1904. 12mo.; pp. 38. Price, 50 cents.

This little pamphlet was written by a boy of sixteen years of age. In it he endeavors to give a brief but intelligible description of the science and mystery of the electrical telegraph, its practical applications and developments. The book is illustrated with a number of cuts, and is an interesting *résume* of the subject.

Forge Practice. By John Lord Bacon. New York: John Wiley & Sons, 1904. London: Chapman & Hall, Ltd. 12mo.; pp. 257; 272 figures. Price, $1.50.

This book is intended for the aid of students in shop work. It contains many practical illustrations of methods employed in all kinds of forging, welding, tempering, etc., as well as an interesting chapter on the metallurgy of iron and steel, which is illustrated with cuts from the Scientific American. The book will be found a practical aid to beginners in the working of iron.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending December 13, 1904

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

Acid, manufacturing nitric, H. Pauling.. 777,486
Advertising device, W. J. Paulsen 777,532
Advertising form, corset, D. Kops 777,423
Alarm device or indicator, W. Puckett.. 777,538
Amalgamator, E. P. Wilkins..... 777,233
Ammunition wagon or limber, W. Mayer, 777,297, 777,298
Animal trap, G. W. King 777,109
Animal trap, H. Williamson 777,461
Article carrier, A. H. Stuart..... 777,266
Assay button dropper, E. Keller, et al.... 777,421
Augur twisting machine, I. Wantling 777,576
Automatic lubricator, J. Meehan 777,120
Automatic safety switch, E. L. Pence.... 777,430
Automobile stepper attachment, H. M. Landes 777,260
Axle, C. P. Clark 777,243
Axle, car wheel, T. R. Timby..... 777,569
Baby jumper, J. A. Morehouse..... 777,386
Bag. See Mail bag.
Bag closure, E. E. Mead 777,263
Bag fastener, S. Bjarnason 777,367
Bag turning machine, S. T. Lockwood.... 777,427
Bait, artificial, D. W. Brown..... 777,491
Bait holder and fish decoy, V. Le Beau.. 777,382
Baling press, Jones & Schafer..... 777,474
Barrel holder, Woltz & Suman..... 777,463
Basins, fastening device for stationary wash, J. Smith 777,553
Battery case, R. H. & F. H. Wappler.... 777,457
Bearing, car axle, J. E. Hewitt 777,507
Bearing, disk, W. A. Lee 777,519
Bearing, roller, J. W. Moakler..... 777,479
Bed, E. L. Fuller 777,284
Bed attachment, J. W. Caster 777,075
Beer cooler, W. Merz 777,121
Beet topping machine, D. D. Sr., & W. D. Buchtel, Jr. 777,396
Bird trap, S. W. Wilt 777,579
Blank feeding mechanism, J. R. Scott... 777,550
Blanket or strap fastener, Z. T. Beatty.. 777,585
Blast furnace, J. Coyne 777,498
Blind fastener, T. A. Upson 777,160
Block signal system, T. Silvene..... 777,353
Boiler furnace, steam, M. J. Carrigan.... 777,331
Bolt anchor, F. C. Palmer 777,134
Book, combined scrap and invoice, C. E. Blodgett 777,650
Boot, anticalking, R. Y. Luther..... 777,348
Bottle, Y. P. Lee 777,426
Bottle, H. G. Lord 777,477
Bottle, non-refillable, L. Wampler..... 777,455
Bottle, non-refillable, M. M. De Grody.. 777,499
Bracelet or belt, automatically adjustable, F. Mason, reissue 12,294
Brake beam, E. I. Dodds 777,279
Brazing, L. R. Schaap 777,546
Brazing compound, L. R. Schaap 777,547
Brewing, J. Schneible 777,549
Brick mold washing machine, J. E. Fox.. 777,620
Brick molding machine, J. H. Emery..... 777,085
Bucket, Fickinger & Blake 777,500
Buckle, W. Griest 777,627
Building block, crystal, A. Biberfeld.... 777,589
Bung holes or the like, temporary closure, for, Hoerr & Boerschinger 777,100
Burglar alarm, Pickens & Ross 777,535
Button, shirt, G. S. Engle 777,191
Cabinet, kitchen, B. J. Schlanzer, Sr..... 777,438
Calipers and dividers, combined, P. H. Sanger 777,643
Calipers, taper, Creamer & Knowlton, 777,605, 777,606
Call box, J. C. Barclay 777,327
Canceling stamps and postmarking mail, machine for, G. W. White..... 777,270
Candy pulling machine, J. H. Volkmann.. 777,162
Cans, tongueless tearing strip for key opening paint, H. B. Williams..... 777,167
Car coupling, W. S. Lee 777,520
Car diaphragm, G. S. Wood..... 777,234
Car door fastener, J. C. Wands..... 777,456
Car, dumping coke, Ingoldsby & Bowling. 777,472
Car fender, E. Sherwood 777,152
Car, railway, Ingoldsby & Bowling..... 777,473
Car sign, trolley, P. McDonald 777,482
Car, stock, W. F. Ellis 777,614
Car vestibule and step, W. B. Foster.... 777,283
Car vestibule diaphragm, S. D. Fuller 777,285
Cars, magnet contact for propulsion of, J. M. Morgan 777,124
Carbureter, A. J. O'Shea 777,390
Carbureter, explosive engine, F. Patee .. 777,220
Card or label holder, J. W. Cutler..... 777,082
Carrier. See Article carrier.
Cartridge, W. Ulrich 777,319
Carving, imitation wood, J. Walter..... 777,647
Cash register, A. von Hoffmann..... 777,341
Casting apparatus, H. G. Underwood 777,571
Casting, metal, J. H. Forbes 777,338
Chair bottom weaving tool, H. C. Dean.. 777,608
Chalk holder, Links & Kraus..... 777,522
Chalk holder and sharpener, combined, Kraus & Links 777,346
Charring wood refuse, etc., apparatus for, W. A. G. von Heidenstam 777,415
Check, traveler's certified bank, S. D. Scudder 777,149
Check row chain, H. W. Warren 777,458
Cheese cutter, R. P. King 777,640
Chuck for holding articles to be dressed, Krastin & Quigley 777,111
Chute, wagon bed discharging, J. D. Dwyer 777,084
Cigar lighter, J. I. Ayer 777,061
Clay working machinery, measuring drum for, W. R. Cunningham 777,081
Clothes rack, N. M. Coyner 777,185
Coat pad, G. Goldman 777,625
Cock, cylinder, C. B. Alvis 777,364
Coin controlled apparatus, J. C. Copeland.. 777,402
Coin holder or change maker, J. W. Jones. 777,378

Commode, douche, S. & M. Fischer..... 777,195
Concentrator, sand, E. S. Bennett..... 777,176
Concentrator, solution, J. U. Lloyd..... 777,115
Concrete block machine, G. Brady 777,070
Concrete brick pressing machine, H. H. Spears 777,155
Concrete building block forming machine, J. H. Stewart 777,557
Concrete pile forming, pile core for, A. A. Raymond 777,351
Condenser system, F. Ray 777,138
Conveyer, L. Abraham 777,171
Conveyer, W. T. James..... 777,375 to 777,377
Conveyer band, F. Abels 777,363
Conveyer, parcel, L. Abraham 777,235
Cooking by retained heat, apparatus for, F. Kahn 777,103, 777,104
Cooking machine, can, O. E. Vance, et al.. 777,321
Cork puller, T. W. Kennedy 777,380
Corking machine, H. F. Frederic..... 777,502
Corkscrew machine, A. A. Vignos..... 777,161
Coupling, Matson & Robertson..... 777,383
Cover, receptacle, R. E. Deane 777,609
Cream separator, M. Kelley 777,516
Cream separator, C. Walker 777,646
Crushing machine, T. L. & T. J. Sturtevant 777,227
Crushing machine, roll, T. L. & T. J. Sturtevant 777,448
Crushing mill, roller, M. P. Boss..... 777,591
Cultivating implement, R. C. Beauchamp 777,586
Curb and conduit, combined, B. F. Lockwood 777,524
Current motor, alternate, V. A. Fynn... 777,198
Currycomb, C. W. Igo 777,471
Cushion spring support, A. Hirsh..... 777,208
Cushioning device, C. von Philip..... 777,534
Damper, M. J. Carrigan 777,330
Derailment guard, R. J. Edwards. 777,189, 777,190
Derrick, portable, W. G. Read 777,307
Die. See Screw threading die.
Dish drainer, collapsible, D. E. Jones..... 777,211
Disinfecting device, telephone, W. H. Rose 777,310
Disk drill, C. H. Pelton 777,487
Display form, J. T. Brown..... 777,272
Display form, H. O. Miller 777,299
Door bolt and lock, barn, O. G. Parsons 777,135
Door check and closer, J. Bardsley..... 777,393
Door fastener, sliding, P. J. Casserly.... 777,332
Door lock, sliding, I. N. Sweet..... 777,449
Door opener and closer, W. A. Fagan 777,193
Door or window fastener, E. Homer..... 777,342
Door stop or holder, J. R. Fletcher..... 777,408
Dough forming machine, C. F. Dietz 777,335
Dough sheeting and lapping machine, J. H. Mitchell 777,349
Draft equalizer, W. T. Seelye 777,151
Draft rigging carrier, O. S. Pulliam..... 777,539
Drafting appliance, combination, E. J. Early 777,407
Drain pipe, M. H. Rylatt 777,435
Drier, J. Scott 777,225
Drill, H. C. Sergeant 777,311
Drill, G. R. Rich 777,543
Drinking vessel or the like, T. Priestnall 777,305
Dye and making same, blue, Abel & Lutringhaus 777,323
Dynamo, variable speed, A. J. Farnsworth 777,194
Educational appliance, T. E. Thompson.. 777,268
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Elevator safety clutch, A. Whelan..... 777,166
Elevator valves, mechanism for operating automatic, K. E. O. Jansson..... 777,635
Elevator valves, operation of automatic, K. E. O. Jansson 777,636
Embossing machine, A. Nicollet 777,129
Emergency brake, G. Macloskie..... 777,118
Engine speed regulator, explosive, G. Marx, Jr. 777,295
Envelop machine, B. F. Berry 777,588
Eraser cleaner, blackboard, D. S. Ausherman 777,582
Evaporating apparatus, multiple effect, S. M. Lillie 777,114
Excavating cutter, J. B. Cantwell..... 777,180
Excavating machine, J. Helm..... 777,204
Exercising ball, J. Minor 777,478
Exhausting or testing tank, T. J. Cosens. 777,403
Expansion bolt, I. Church 777,399
Explosive and making same, A. Muller-Jacobs 777,125
Fascine, H. F. Kellner 777,288
Faucet, C. A. Smith 777,265
Feed controller, J. P. Wymer 777,361
Feed mechanism, boiler, P. Marshall.... 777,119
Feeder, C. W. Thomas 777,355
Fence, flood, J. Elliott 777,613
Fence post, J. W. Childs 777,600
Fence wire, barbed, A. B. Frost, et al.. 777,622
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Furnaces, means for feeding air into steam boiler, D. A. Reagan 777,139
Gage. See Track gage.
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Garment hanger, A. H. Sinsheimer..... 777,354
Garment hanger, E. M. Webster..... 777,357
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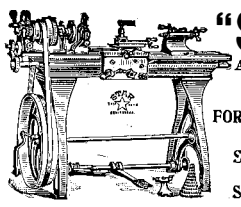

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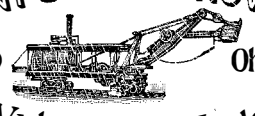
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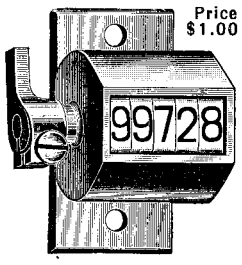

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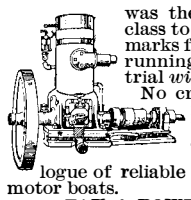
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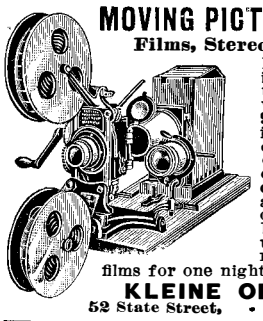
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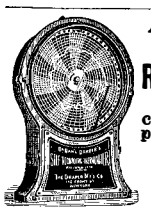
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Hinge, J. A. Wells 777,230
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Light. See Portable light.
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Lock, D. R. Reefe 777,141
Lock, Alrutz & Werner 777,271
Lock attachment, cylinder, C. O. Noack.... 777,130
Loom box motion, W. A. Fowler 777,196
Loom filling end clearer, A. E. Benson 777,237
Loom, filling replenishing, B. Crossley 777,276
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Lubricating wheel flanges, device for, J. H. Miner 777,428
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Magnet, lifting, S. Piek 777,221
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Muzzle, dog, W. H. Dusenbury 777,280
Nail extractor, G. & H. A. Hovenden 777,210
Nursery gate, C. H. Wright 777,322
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Nut lock, L. C. Amberson 777,469
Nut wrench, J. M. Briscoe 777,238
Oil supplying indicator, J. Meehan 777,528
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Ore leaching apparatus, W. S. Jones 777,379
Ore screen, shaking, J. A. Traylor 777,317
Ores, concentration of minerals from, A. E. Cattermole, et al. 777,274
Ores from gangue, separation of the metallic constituents of, A. E. Cattermole 777,273
Organ attachment, pipe, N. Olsson 777,133
Package, candy, D. J. O'Brien 777,132
Packing, Cole & Sackett 777,275
Packing case, folding, O. Clawson 777,601
Pad. See Coat pad.
Paper machine, cylinder, J. R. Kennett 777,345
Paper pasting machine, wall, M. A. Roberts. 777,433
Paper stock filter, C. Tittel 777,316
Paper with glue or other suitable pasting material, machine for providing sheets of, W. Kellner 777,258
Pavement composition, E. I. Allison 777,173
Peanut picking machine, W. R. Jones 777,287
Peeling machine, potato, A. A. de Bonneville 777,590
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Railway crossing, G. W. Lancaster	777,424
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Railway gate, Lacy & Rogers	777,518
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Railway tie plate, W. F. Gould	777,253
Rake. See Stalk rake.	
Reamer, J. Smith	777,154
Reciprocating engine, C. King	777,108
Refrigerator attachment, A. J. Chaffin	777,076
Registering apparatus, H. Hollerith	777,209
Resistance, variable inductive, T. B. Kinraide	777,290
Rheostat, H. H. Cutler	777,246
Rheostat, W. L. Schmidt	777,439
Rheostat, Keeney & Rhine	777,637
Rheostat, automatic, R. J. Louis	777,116
Rivet set locking device, W. C. Lippert	777,476
Robe holder, N. Livingston	777,523
Rock drill valve, T. J. Murphy	777,529
Roof anchoring device, W. Small	777,441
Rotary engine, W. Wyand	777,360
Rotary engine, W. F. R. Mist	777,384
Rotary engine, E. S. Higgins	777,417
Rotary motor, J. Osvetimsky	777,302
Rubber heels, making, R. E. Foster	777,653
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Sander, pneumatic, J. Farley	777,087
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Sash fastener and tightener, adjustable, N. S. Hillyard	777,099
Saw carriage power set works, Tullock & Barnes	777,318
Sawmill set works, T. S. Wilkin	777,232
Sawing apparatus, V. Pfaff	777,533
Scale, weighing, J. E. Cochran	777,602
Screw threading die, A. J. Smart	777,442
Seal, sheet metal, F. W. Brooks	777,329
Sealing cap, bottle, A. A. Wood	777,168
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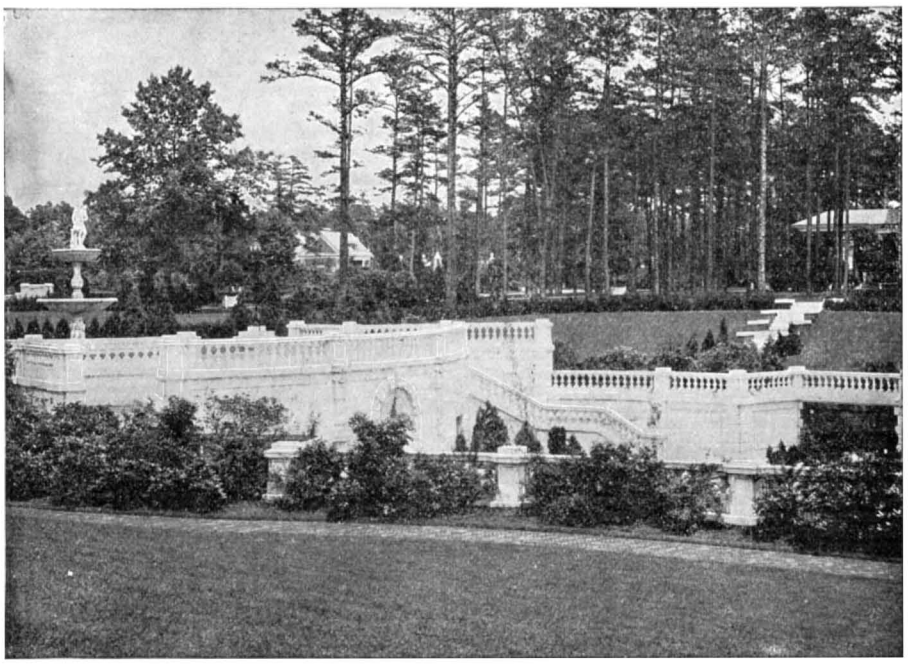

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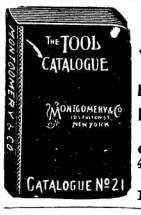

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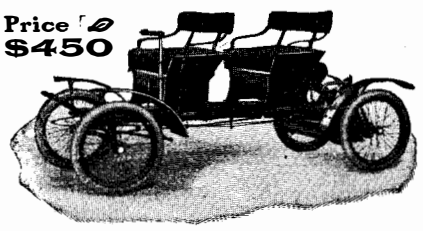

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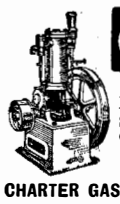

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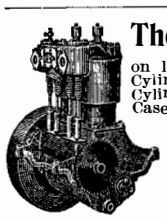

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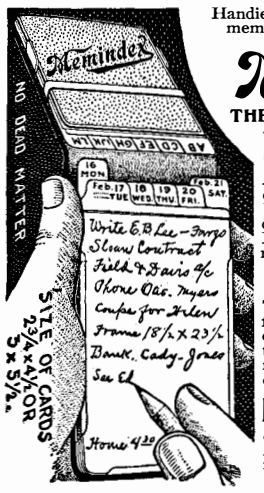

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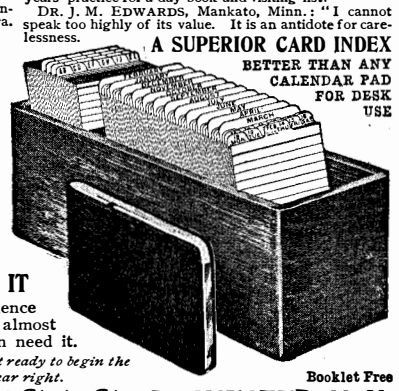

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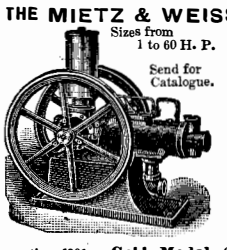

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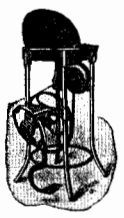

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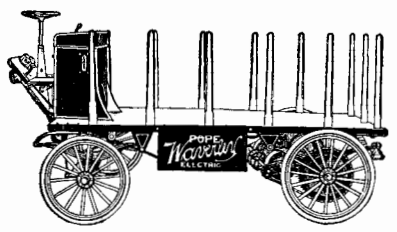

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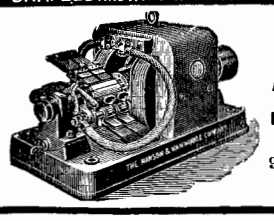

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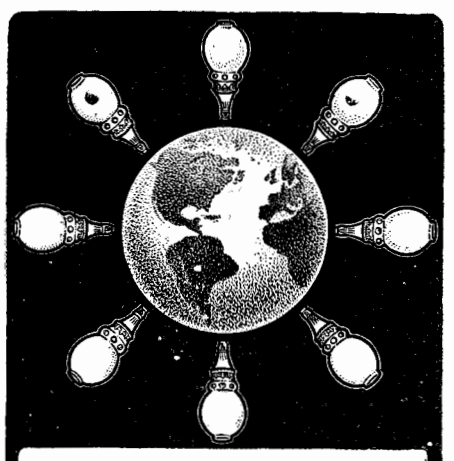

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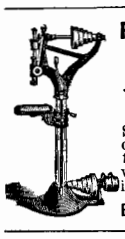

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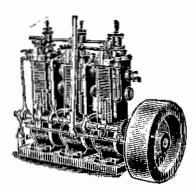

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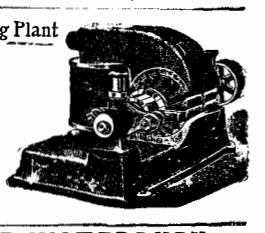

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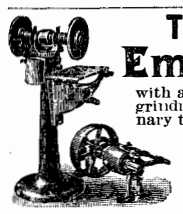

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